APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

OCTOBER, 1951

OCT 12 1951
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- HYDRAULIC CIRCUITS
- HYDRAULIC CONTROLS
- AIR CIRCUITS
- AIR CONTROLS
- ELECTRICAL AND ELECTRONIC CONTROLS

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PACKAGED CONTROLS SIMPLIFY PIPING PROBLEMS IN REDESIGN

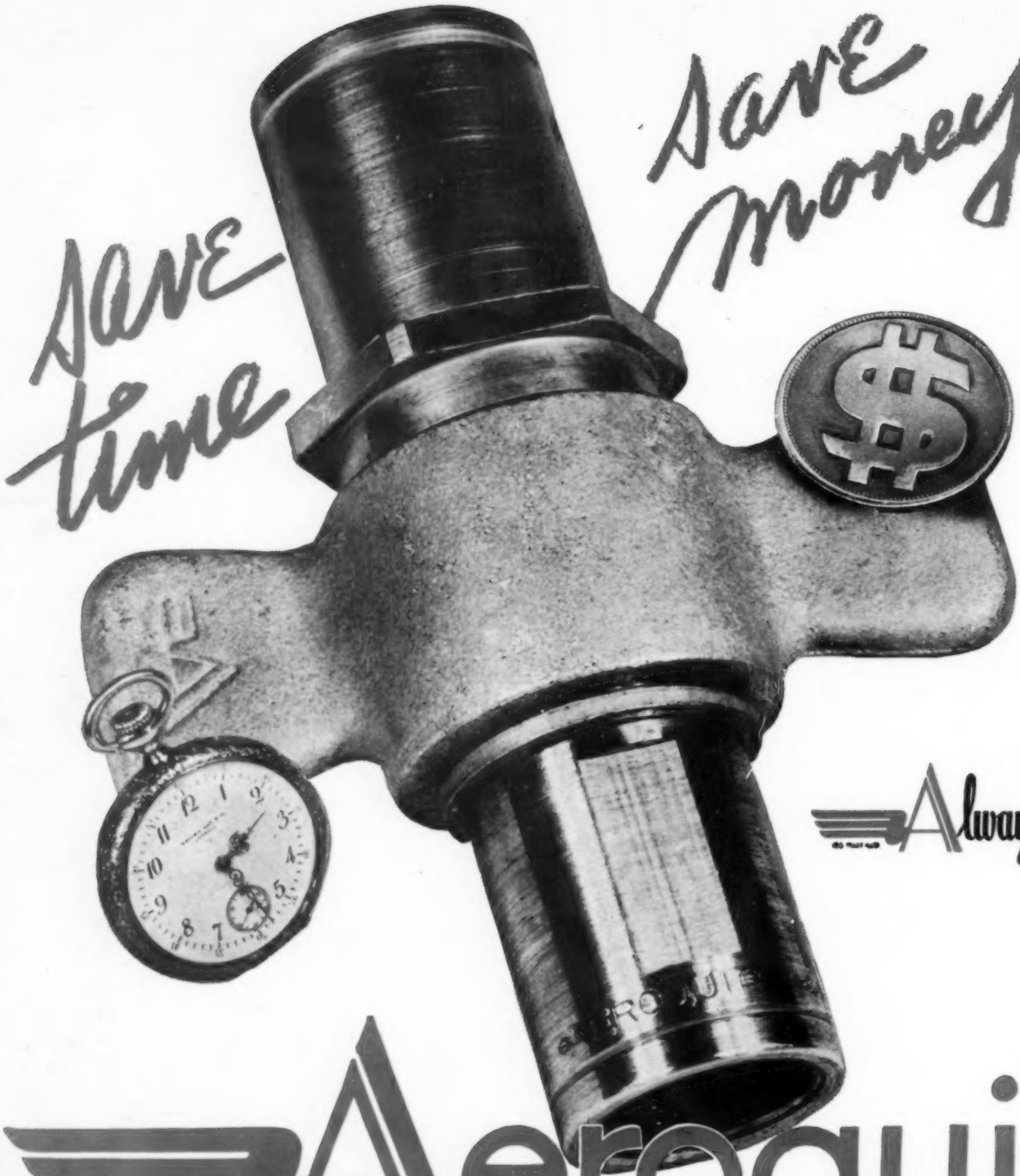
PANELIZED HYDRAULIC SYSTEM

INTERNAL RAM SPEEDS EXTRUSION

FLUID TRANSMISSIONS THE KEY TO STOKER EFFICIENCY

TRIM LINE USES SERVO CONTROL

DIE CAST SAFETY CIRCUIT DESIGN REDUCES FIRE HAZARD



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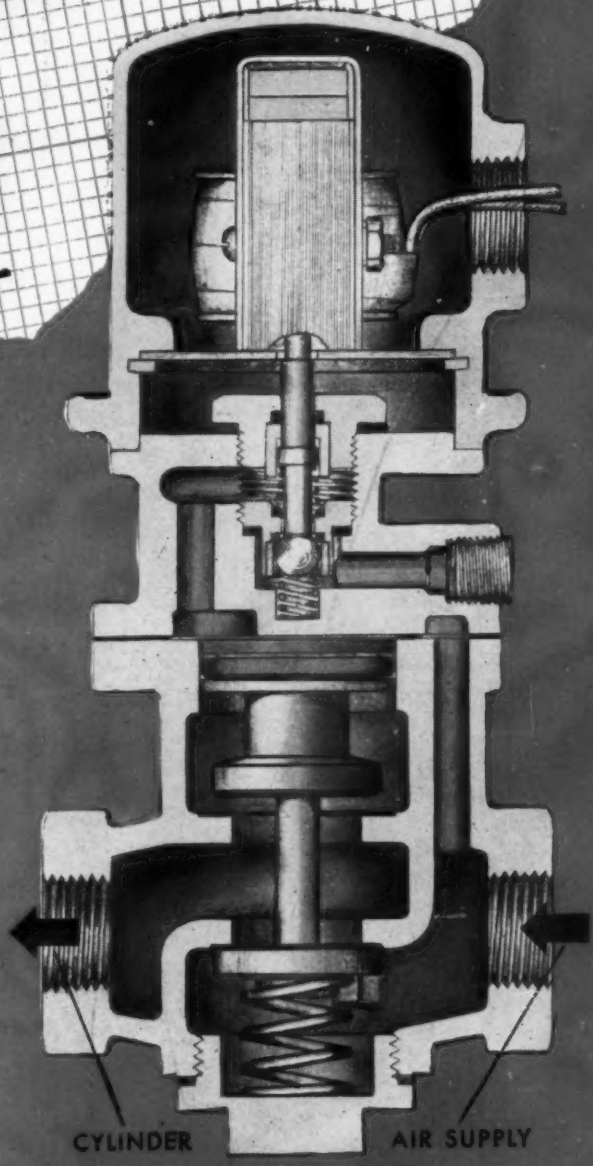

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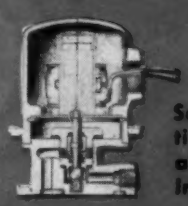

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applied HYDRAULICS

October, 1951 Vol. 4, No. 10

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AT&T Teletypewriter
Number is CV-223

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LOS ANGELES OFFICE
FRED W. FRIESENFELDT
Industrial Publishing Co.
Room 602
1250 Wilshire Blvd.
Los Angeles 17, Calif.
TUcker 6703

LONDON OFFICE
JOHN A. LANKESTER
10 Brunswick Road
Kingston Hill, Surrey
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Published monthly by THE HYDRAULICS PUBLISHING CO., an affiliate of INDUSTRIAL PUBLISHING CO., publishers of COMMERCIAL REFRIGERATION & AIR CONDITIONING, PRECISION METAL MOLDING, FLOW, INDUSTRY & WELDING, and OCCUPATIONAL HAZARDS. Member, Controlled Circulation Audit, Inc.

Subscription rates: United States and possessions—$3.00 per year, $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year. Single copy price, 30 cents. All subscriptions subject to individual acceptance by the publisher.

(Application is pending for acceptance under section 34.64 P.L.&R.)

FRONT COVER: Edge trimming on this mill is precisely controlled by an oil cylinder. This electro-hydraulic servomechanism is described in an article on page 42.

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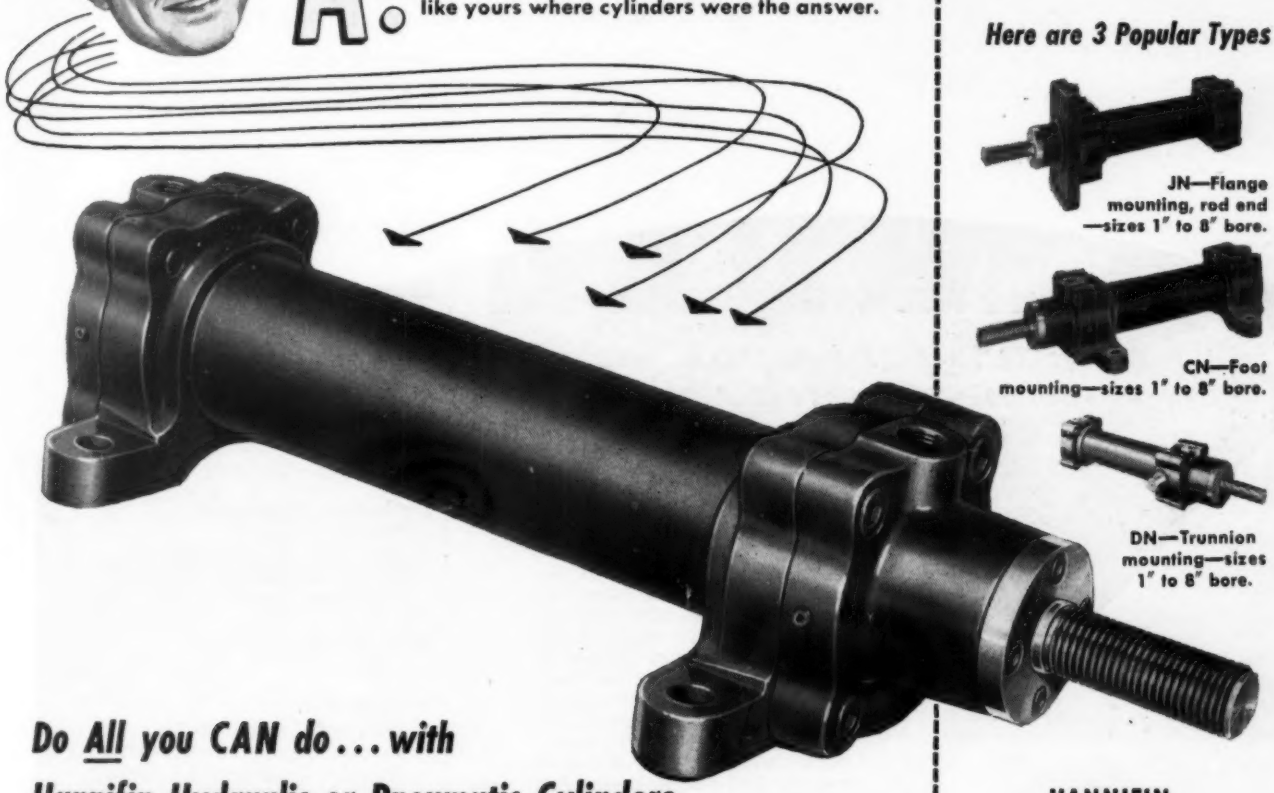
A: You can save time, reduce physical effort, cut operating costs! We know, because our experience includes a number of jobs just like yours where cylinders were the answer.



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PRODUCT INDEX

Advertised Components in This Issue

This index includes products advertised in this issue; based on information available prior to closing date.

Accumulators
Bendix Aviation Corp., Pacific Div.
Greer Hydraulics, Inc.

Air Trap
W. H. Nicholson & Co.

Bearing Bronze
American Crucible Products Co., The

Compressors, Aircraft
Cornelius Company
Walter Kidde & Co., Inc.

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Aeroquip Corporation

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Hannifin Corporation
Petch Manufacturing Co.
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Lima Electric Motor Co.

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Fittings, Hose
Anchor Coupling Co., Inc.
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Fittings, Swivel
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Lovejoy Flexible Coupling Co.

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Pumps, Reciprocating Plunger
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Pumps, Vane
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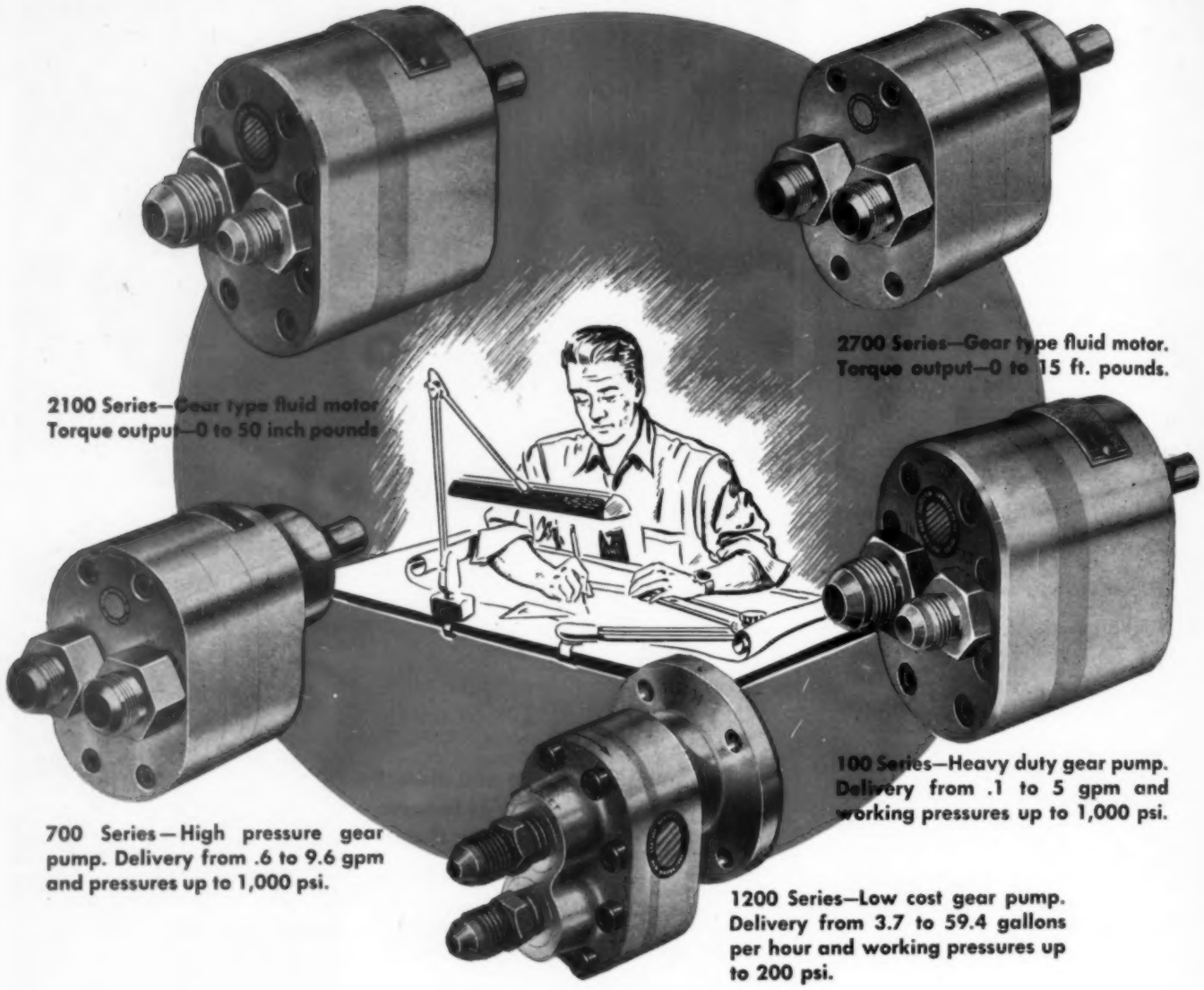
2700 Series—Gear type fluid motor. Torque output—0 to 15 ft. pounds.
2100 Series—Gear type fluid motor. Torque output—0 to 50 inch pounds
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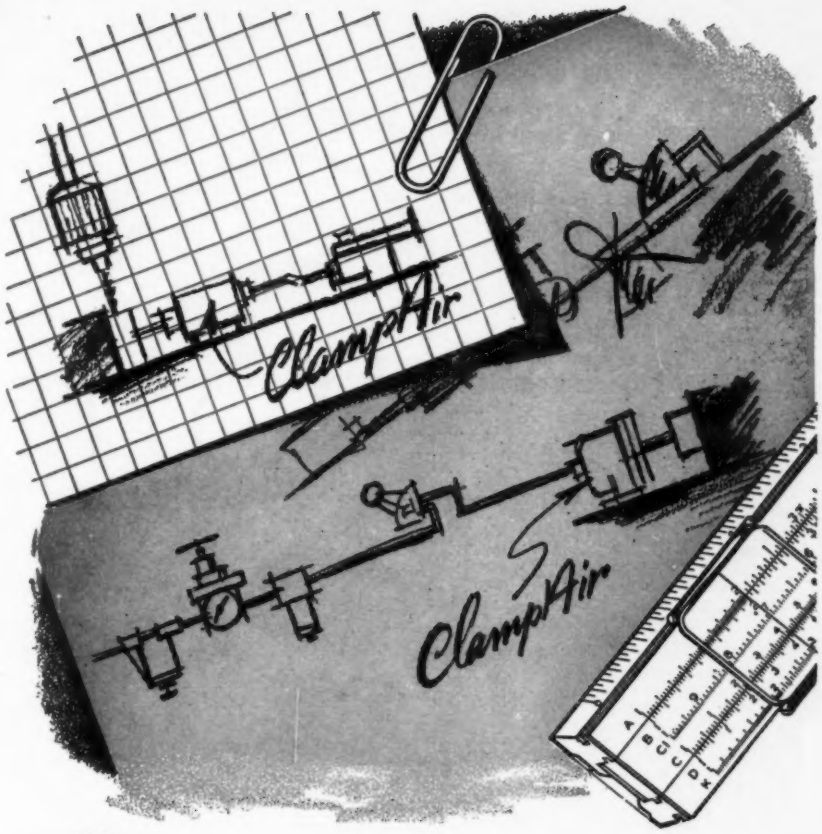
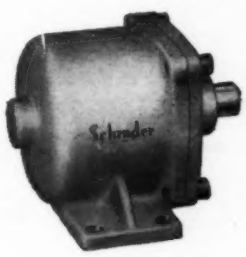
Three Way Valve—This inexpensive valve will give long service and is designed to operate small bore single acting cylinders such as the Schrader ClampAir. The stainless steel lever is functionally designed for positive stops and facilitates comfortable hand operation. A small hole in the lever provides means for mechanical operation if desired.

Valves With Hand Lever (Two, Three and Four-Way Types) Durability and simplicity of construction feature these forged brass valves which are designed for easy hand operation. One hardened steel bolt holds the two-piece body and internal parts in place and contributes to time-saving, low-cost maintenance.

Valves With Mechanical Lever (Two, Three and Four-Way Types) This type valve is similar to the one described above but has a lever arranged for mechanical actuation to provide automatic operation. The rugged steel lever will stand up under rapid actuation over long periods of use.





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LETTERS to the Editor

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J.C.R.

The Leonard "Tubemaster", made by the Leonard Precision Products Company, 15002 E. Larson Ave., Garden Grove, California, is such a machine and is widely used in the aviation industry for both squaring and flaring of hydraulic tubing.

I would appreciate very much if you would give me the name of the manufacturer of the press illustrated on page 40 of your August issue in the story "Another Industry Turns to Hydraulic Power".

E.A.C.

The manufacturer of this equipment is Benjamin Lassman & Son Company, Oliver Building, Pittsburgh, Pa.

I am completing a survey of hydraulic actuating fluids in which it is proposed to include proprietary brand names for the benefit of prospective users. Your assistance, particularly American manufacturers of synthetic fluids, will be greatly appreciated.

H.E.H.
(London, England)

Among leading American manufacturers of synthetc hydraulic fluids (emphasis on nonflammable) are: Special Products Division, Carbide & Carbon Chemicals Corp., 292 Madison Ave., New York 17, N.Y., "Ucon" fluids; Celanese Corp. of America 2 Park Ave., New York 16, N.Y., "Lindol HF"; Monsanto Chemical Company 1700 S. 2nd St., St. Louis 4, Mo., "Pydraul F9' (general nonflammable use), "Skydrol", "Araclor 1248" (die casting) and "OS-16" (mining); R. M. Hollingshead Corp. Camden, N. J., "H-2"; Standard Oil Company of California, 225 Bush St., San Francisco, Calif. "RPM".

(Continued on page 14)

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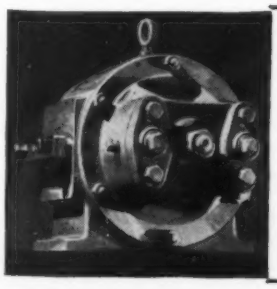

HELE-SHAW . . . variable pressures up to 3000 p.s.i.

The Hele-Shaw is a radial-piston variable displacement fluid power generator. Pressure and reversal of flow are controlled directly at the pump. Discharge can be varied from zero to maximum . . . and can be reversed gradually or instantaneously. Suitable controls available. Capacities range from 3¾ to 50 g.p.m. and upward.

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Company_____

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WILLIAMSPORT 15, PA.

PUMCUPS

Letters to the Editor

(Continued from page 12)

At the present time we are contemplating entering into the manufacture of hydraulic machines and would like to familiarize certain members of our engineering staff with hydraulics. We would like to know if the series "Beginners Course in Basic Hydraulics" is available in complete form. Any help you can give us in this matter will be greatly appreciated.

D.T.

This series is still incomplete and we have no plans for republishing the material in collected form. While we used a Navy training text for some of the earlier installments ("Basic Hydraulics", available from the Superintendent of Public Documents, U.S. Government Printing Office, Washington 25, D.C. at $1.50 per copy) much of the latter material, including all the material on pumps (January 1951 issue on) has been staff written.

Can you suggest the names of manufacturers who make hydraulic piston equipment as such. We would be interested in special purpose machinery for this work.

As far as we know there are no special purpose machines built by the machine tool or press manufacturers as "catalog" items. However, a number of the leading hydraulic press manufacturers do build such equipment to special order. As you are in the East, we suggest you get in touch with one of the following: Watson-Stillman Company, 109 Aldene Rd., Roselle, N. J.; Farell-Birmingham Company, Ansonia, Conn.; Birdsboro Steel Foundry & Machine Company, 1941 Furnace St., Birdsboro, Pa.; or the Eddystone Division of Baldwin - Lima - Hamilton Works, Philadelphia 42, Pa.

I am interested in the design and application of hydraulic seals for heavy and light work. Could you tell me where I could obtain a book on the subject?

W.H.MCC.

Other than several excellent manuals or handbooks by manufacturers, the only book on the subject that we are famil-

(Continued on page 18)

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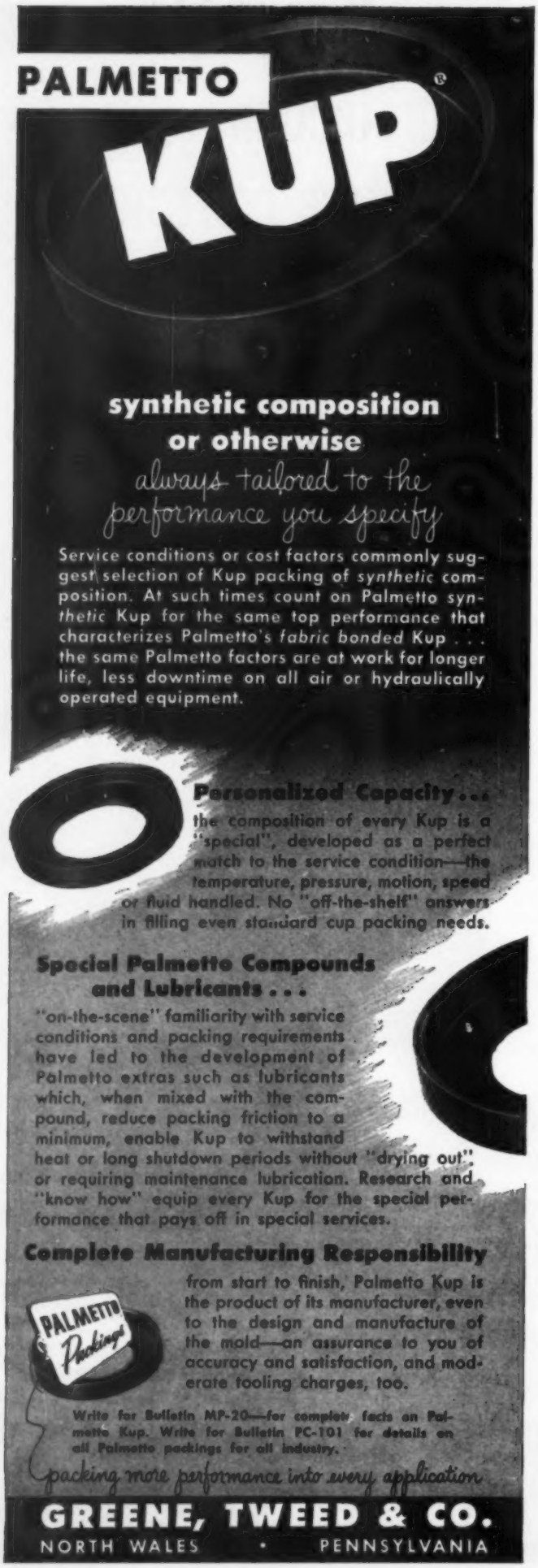

PALMETTO
KUP
synthetic composition
or otherwise
always tailored to the
performance you specify
Service conditions or cost factors commonly suggest selection of Kup packing of synthetic composition. At such times count on Palmetto synthetic Kup for the same top performance that characterizes Palmetto's fabric bonded Kup . . . the same Palmetto factors are at work for longer life, less downtime on all air or hydraulically operated equipment.
Personalized Capacity . . .
the composition of every Kup is a "special", developed as a perfect match to the service condition—the temperature, pressure, motion, speed or fluid handled. No "off-the-shelf" answers in filling even standard cup packing needs.
Special Palmetto Compounds and Lubricants . . .
"on-the-scene" familiarity with service conditions and packing requirements have led to the development of Palmetto extras such as lubricants which, when mixed with the compound, reduce packing friction to a minimum, enable Kup to withstand heat or long shutdown periods without "drying out" or requiring maintenance lubrication. Research and "know how" equip every Kup for the special performance that pays off in special services.
Complete Manufacturing Responsibility
from start to finish, Palmetto Kup is the product of its manufacturer, even to the design and manufacture of the mold—an assurance to you of accuracy and satisfaction, and moderate tooling charges, too.
PALMETTO Packings
Write for Bulletin MP-20—for complete facts on Palmetto Kup. Write for Bulletin PC-101 for details on all Palmetto packings for all industry.
packing more performance into every application
GREENE, TWEED & CO.
NORTH WALES • PENNSYLVANIA

Letters to the Editor

(Continued from page 14)

iar with is "The Sealing Mechanism of Flexible Packings" by C. M. White and D. F. Denny, an English book published by His Majesty's Stationery Office, British Ministry of Supply, as Scientific & Technical Memorandum No. 3/47. This book is available from the British Information Service, 30 Rockefeller Plaza, New York 20, N. Y. The handbooks include those issued by E. F. Houghton Co. (3rd Edition 1948), Linear, Inc. (11th Edition 1950) and Precision Rubber Products Corp. (4th Edition 1950). The catalogs of other seal manufacturers may be noted from advertisements in APPLIED HYDRAULICS.

I am interested in securing all possible information about the Joint Industry Committee for Hydraulics. Your cooperation will be appreciated.

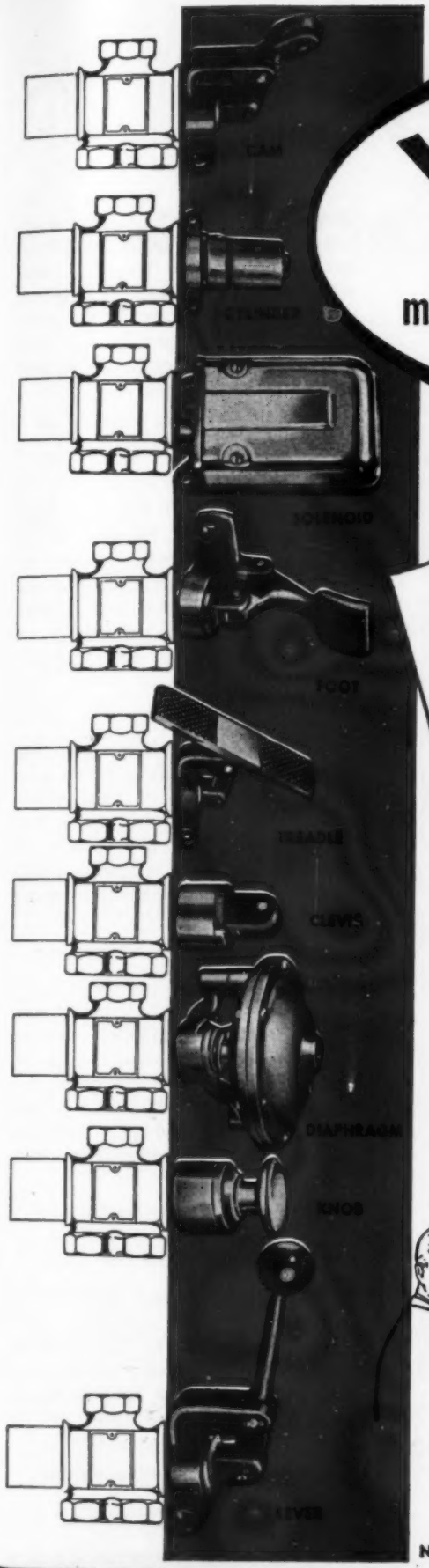
V.W.B.

The Joint Industry Conference on Hydraulic Standards grew out of a General Motors Corporaton plant committee much in the same way as similar J.I.C. Standards on electrical equipment and on machine tools grew. Other automotive manufacturers and their suppliers in the hydraulic field joined by invitation to set up the Standards. The first edition of the J.I.C. Hydraulic Standards for Industrial Equipment was published in September 1948. A second edition, with only relatively minor modifications, was issued in September 1949. This is the current edition. The Standards are general performance standards, not detailed specifications. The chairman of the J.I.C. Hydraulic Standards is R. L. Wilhite, Production Engineering Section, General Motors Corporation, 15-228 General Motors Bldg., Detroit 2, Mich.; the secretary is R. M. Mitchell of the same address.

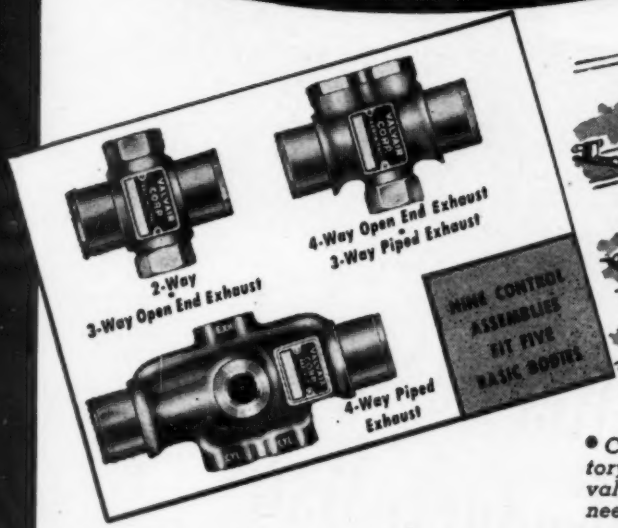
Can you direct us to anyone who might be able to supply us with a hydraulic booster steering for the Oliver "900" tractor? We are urgently in need of this information and your efforts in our behalf would be greatly appreciated.

G.P.M.

We've done a little checking and find that the R. A. Garrison Mfg. Company, 1506 S. Santa Fe Ave., Los Angeles 21, Calif. build a booster that has been used efficiently on this model tractor.



VALVAIR
Diversatility
means that you "reach for merely an end" instead of an entire valve



• *Conserve your valve inventory. Cut down on complete valves—stock the "ends" you need and just a few parts.*

Only Valvair gives you this unique interchangeability. Nine control assemblies fit the cylindrical ends of three different body designs. These three bodies answer for Valvair's five basic valve types. Internal parts are likewise interchangeable. Multiply by five sizes and add hundreds of variations. Then you will see why Valvair "Diversatility", affording many thousands of different combinations, can fill *any* air control requirement.

Valvair's rugged construction makes for long, uninterrupted service. If conditions demand a new control method, merely "change ends"—not whole valves. Your piping stays, undisturbed. A few minutes—that's all. Maintenance, expense and down time drop. Production goes up.

★ ★ ★

2-way, 3-way and 4-way open-end exhaust, 3-way and 4-way piped exhaust valves for controlling air, vacuum, water, oil or inert gas pressures up to 175 p.s.i. and temperatures to 140°. Sizes ¼", ⅜", ½", ¾", 1".

Diversatility. "I don't have to tear down the piping to change packers or operating control".

ALSO, VALVAIR "DIVERSATILITY" MAKES POSSIBLE A BETTER VALVE AT COMPETITIVE PRICES. WRITE FOR OUR BULLETIN "A".

No. 3

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Sales Representatives in Principal Cities Throughout United States and Canada

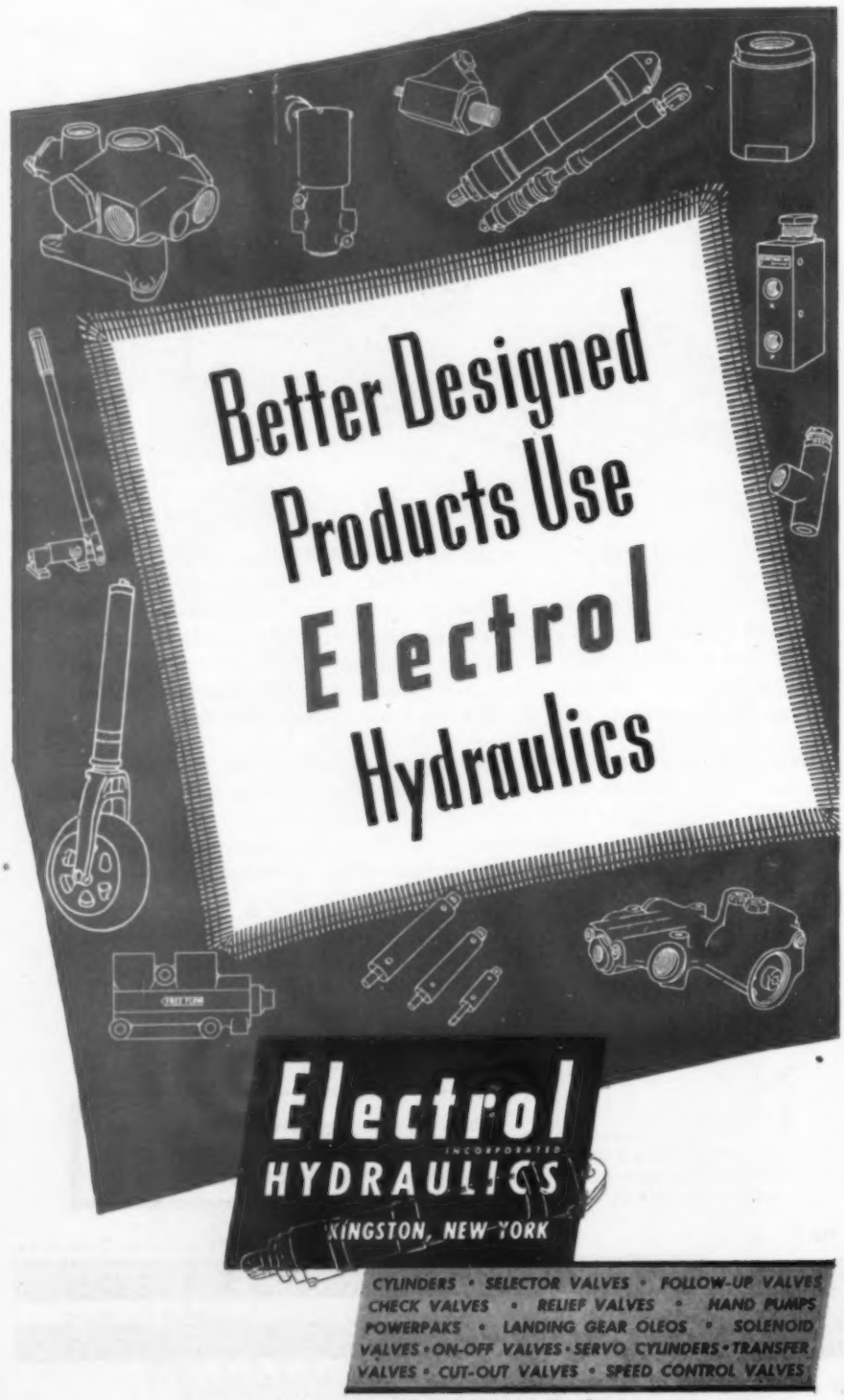
Literature and Services Offered in this Month's Ads

ARE YOUR FILTERS INSTALLED properly? In descriptive literature offered by The Hilliard Corporation recommendations for the proper installation of earth type filters are given.

Circle 79 on Reader Service Card

A SIMPLE, COMPACT power source for opening and closing butterfly and gate valves is the air or oil cylinder. These actuators are described in Ledeen Bulletin 512.

Circle 85 on Reader Service Card



Circle 21 on Reader Service Card

QUICK CONNECTIVE fluid line couplings save producting time. The Hansen Manufacturing Company will send you a complete catalog giving descriptions and sizes of the complete line of straight through and shut-off couplings for hydraulic and pneumatic connections.

Circle 10 on Reader Service Card

HERE'S A BOOKLET for your engineering library. E. F. Houghton & Co. offers their latest bulletin which includes complete standardization data on Houghton leather and synthetic rubber packings.

Circle 30 on Reader Service Card

SAFE AND CONVENIENT operation of air powered tools is made possible by the use of dependable valve couplings. C. B. Hunt & Son Bulletin No. 104-C give details on their in-line hose couplings which permit quick on-off control of air power.

Circle 80 on Reader Service Card

PROTECTING PRECISION finished cylinder rods from galling is no problem if you give some thought to this important detail. Hydraulic Accessories Co. will send you specifications on their "Seal-Guard" metallic rod wiper.

Circle 82 on Reader Service Card

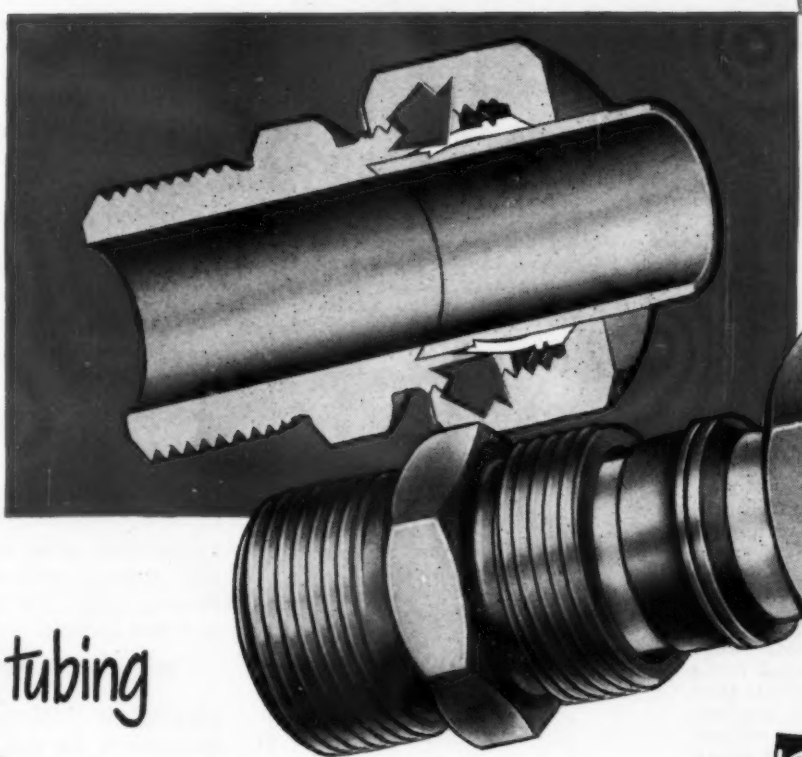
ELECTRICAL operation of air valves provides automatic, precision control. Hannifin Bulletin 230 contains specification, dimension table and wiring diagrams for limit switch or push button operated valves for air circuits.

Circle 65 on Reader Service Card

"HYDRAULIC BULLETIN" is the new 8 page booklet offered by Honan-Crane Corporation. Case histories describe in detail the advantages of oil purification.

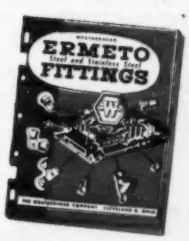
Circle 43 on Reader Service Card

This Weatherhead ERMETO® "ring" gives you timesavings up to 60%



Notice drawing at left. See how ERMETO nut presses sleeve as threads engage. Forces acting on sleeve cause it to bow slightly and actually shear into the surface of the tube. This strengthens the seal, distributes vibration strains and holds a constant tension between body and nut to prevent loosening.

on steel tubing installations... up to 40% on copper and aluminum!



WRITE for full information—ask for ERMETO catalog No. E-1457. Contains details on ERMETO sizes available in steel, stainless steel and brass, installation data, etc. Dept. A, The Weatherhead Co., 300 East 131st Street, Cleveland 8, Ohio.

The Weatherhead ERMETO "ring" or hardened sleeve is the heart of the fitting—enables tube connections to be made at all pressures—economically at low pressures, *safely and economically* at elevated hydrostatic pressures. There's NO FLARING, NO THREADING, NO WELDING, NO SOLDERING—*fast installation with no tools but a wrench!* Easy disassembly and retightening with a pressure-tight joint. Ermeto fittings meet J. I. C. requirements.

The Mark of Quality

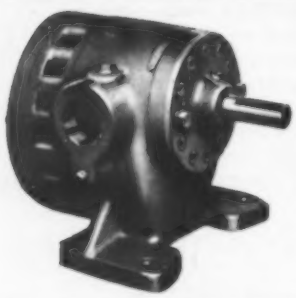
WEATHERHEAD

FIRST IN HYDRAULIC CONNECTIONS

LIFT LOWER PUSH PULL

...for Dependable Hydraulic Service, install ROPER *Rotary* PUMPS

PRESSURES TO 1000 P.S.I.



Roper *dependable* Pumps! Smooth running units that add to the efficiency of diversified hydraulic applications. The Roper principle of only two moving parts—equal size pumping gears operating in a sturdy case with proper clearance—results in superior serviceability and promotes long life. The Roper Pumps illustrated are representative of standard pumps suitable for most installations. For unusual applications, let Roper engineers work with your design engineers in developing a special Roper to fit your needs.

SERIES H . . . Pressures to 1000 P.S.I.—Capacities 10 to 75 G.P.M. Spur gears operate in axial hydraulic balance . . . roller bearings and bronze wear plates reduce friction under heavy loads . . . splined drive shaft absorbs thrust loads. Most models can be direct connected, belt, or gear driven. Packed box or mechanical seal.

SERIES K . . . Pressures to 150 P.S.I.—Capacities ¼ to 50 G.P.M. Compact, yet sturdy enough to handle a wide range of jobs. Self-lubricated by liquid being pumped . . . handle total suction lifts up to 25 feet . . . come equipped with mechanical seal or packed box, with or without relief valve. Easy to install and apply.

SEE OUR CATALOG IN SWEET'S

SERIES F . . . Pressures to 300 P.S.I.—Capacities 1 to 300 G.P.M. Popular pumps that feature 4-port design (eight optional piping arrangements, 4 for clockwise and 4 for counter-clockwise rotation.) Supplied in standard or stainless steel fitted models to suit specific needs. Furnished with or without relief valve, with mechanical seal or packed box. Ideal for hydraulic power generation in a wide range of applications.

Send For Free Booklet

"HOW TO SOLVE PUMPING PROBLEMS"

ROPER *Rotary Pumps*

GEO. D. ROPER CORPORATION
710 Blackhawk Park Avenue, Rockford, Illinois

☐ *Please Send Booklet "How To Solve Pumping Problems"*

NAME_____

ADDRESS_____

CITY_____

COMPANY_____

Literature Offered in This Month's Ads

(Continued from page 20)

"HOW TO SOLVE PUMPING PROBLEMS" is the title of a handy booklet prepared by Geo. D. Roper Corporation. You'll find charts, tables and typical problems in selecting pumps all worked out.

Circle 23 on Reader Service Card

LEATHER PACKINGS Want to know more about Rhoads Tannate to meet your exact packing requirements? Write to J. E. Rhoads & Sons for details.

Circle 52 on Reader Service Card

CONSIDER HOSE assemblies for circuit flexibility and convenience. Resistoflex Corporation has prepared specification sheets for their line of assemblies.

Circle 49 on Reader Service Card

HERE'S THE STORY of what happens to "V" type packings under pressure. Raybestos-Manhattan, Inc. has run photoelastic stress analyses and radial pressure tests on their Vee-Flex Packing rings. This data is available in a free bulletin.

Circle 5 on Reader Service Card

CARTRIDGE TYPE packing gland is featured in the design of Petch cylinders for air and hydraulic service. Engineering data on these cylinders with a self contained packing gland is offered.

Circle 78 on Reader Service Card

HAVE YOU CONSIDERED the unloading Gear-type gear pump for conventional variable volume pump applications? Specifications and performance charts are available on this new Pesco design.

Circle 1 on Reader Service Card

THE BEST WAY to know what size packings are readily available is to have a list of mold sizes carried in stock by the manufacturer. Along with complete packing data, Periflex, Inc. supplies you with this information.

Circle 67 on Reader Service Card

HOSE ASSEMBLY design to provide safe, reliable connections is an important engineering problem. The new Mulconroy "Press-Lock" construction is fully described in free literature.

Circle 56 on Reader Service Card

The next packing problem he helps to solve can be yours!

● You'll find Houghton engineers are well equipped to help you with hydraulic and pneumatic packing problems.

Call on them with confidence for original packing designs. Or enlist their aid in recommending improvements on existing designs. They'll bring with them a knowledge gained over 44 years of engineering service to machine designers.

Service such as this has been responsible for many of the packing improvements noted throughout industry today. In helping the designer, Houghton engineers bring out new and better packings for the field.

Can you use this engineering service in solving your specific packing problems? No obligation. Write or call E. F. Houghton & Co., Philadelphia 33, Pa.

Write for latest bulletin which includes complete standardization data on Houghton VIM Leather and VIX-SYN Synthetic Rubber Packings.

Leather & Synthetic Packings
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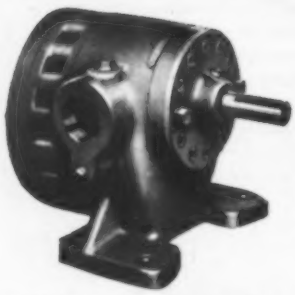
E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

LIFT LOWER PUSH PULL

...for Dependable Hydraulic Service, install ROPER *Rotary* PUMPS

PRESSURES TO 1000 P.S.I.



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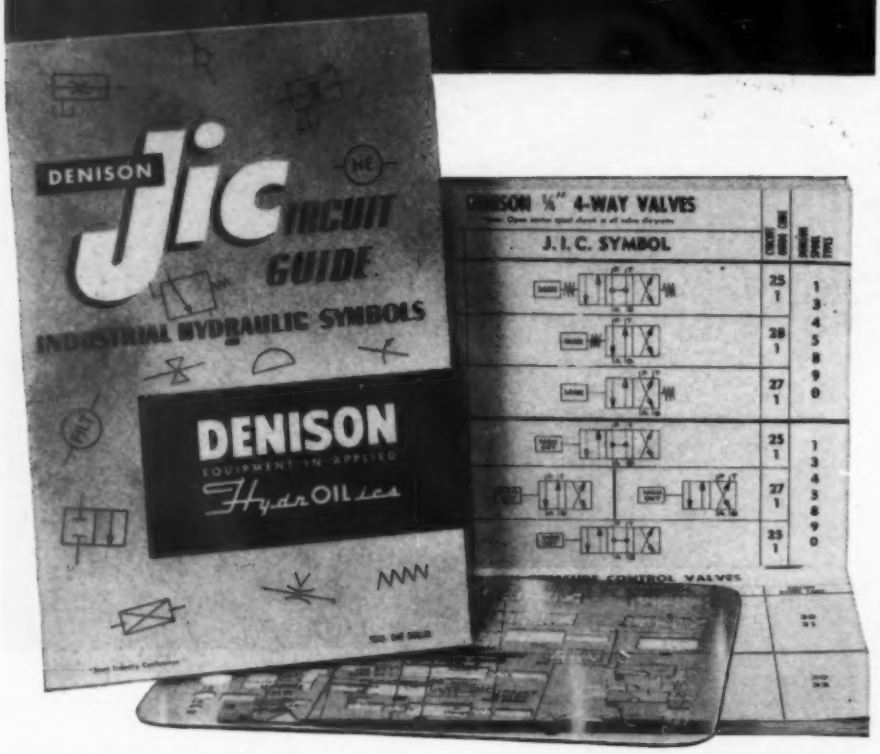
Ready to give you on-the-job service . . .

YOURS—for easier circuit planning



Complete Joint Industry Conference Code Book and Template

This handy JICircuit Guide, complete with plastic *drawing template,* puts all information on JIC symbols and their use at your fingertips — ready for quick reference and easy transfer to your circuit diagrams. It saves time, makes circuit planning easier, and quickly identifies standard JIC symbols.

Symbols in all key examples are standard, as approved by the Joint Industry Conference for Industrial Equipment. The kit includes a 32-page booklet that not only provides all basic JIC symbols for industrial hydraulics, but is also referenced to all cataloged Denison equipment. *This is not a gadget;* it will be your handiest tool for all circuit diagrams.

Denison has developed this Circuit Guide and Template to make the new standard JIC symbols as easy to use as any others. Although priced at $1.00, this valuable kit is available *without cost or obligation* to anyone actively engaged or interested in hydraulic designing or engineering. Just give us your name and position or title, on your business letterhead, and your JICircuit Guide and Template will be sent to you promptly, with our compliments. Or if you have a specific problem, contact the Denison representative in your area, who will also gladly see that you get a copy of the Guide. (Schools or student groups are invited to inquire about special rates on quantity lots.) Write today!

The DENISON Engineering Co. 1166 Dublin Rd., Columbus 16, Ohio

DENISON HydrOILics

All Roads Lead to Detroit

THE 33RD NATIONAL METAL Congress and Exposition, held simultaneously with the First World Metallurgical Congress, will make Detroit the metallurgical capital the week of October 15-19.

The National Metal Congress, sponsored by the American Society for Metals, American Welding Society, Institute of Metals Div., American Institute of Mining and Metallurgical Engineers and the Society for Non-Destructive Testing, has schedules of seminars, sessions and meetings on technical subjects on metals production, treating and processing.

The theme of the Congress and Exposition will be "Production for Defense"; the purpose being to bring together the experience, the knowledge and the means for a more effective use of metals through engineering and, through conservation and substitution, to insure an adequate supply of materials and material combinations for the strengthening of defense and the preservation of our security.

350 Exhibitors

The National Metal Exposition will be held at the Michigan State Fair Grounds; the site of which is less than nine miles from downtown Detroit. Over 350 nationally known organizations, engaged in either the production, treatment or fabrication of metals or in rendering services to such firms, have reserved nearly 300,000 square feet of floor space—approximately 6 ½ acres in area—for exhibits. A record attendance of well over 40,000 industrial representatives are expected to attend.

The ASM seminar on metal interfaces will be held on the 13th and 14th; all other tech-

nical sessions, including the ASM Educational Lectures, will be held Monday through Friday, October 15-19.

The other sponsoring societies, as usual, will hold separate technical sessions. The ASM technical meetings will be held at Hotel Statler; American Welding Society meetings at the Book-Cadillac Hotel; AIME meetings at the Detroit-Leland Hotel; the Society for Non-Destructive Testing at Hotel Detroiter. The World Metallurgical Congress will hold sessions at Hotel Tuller.

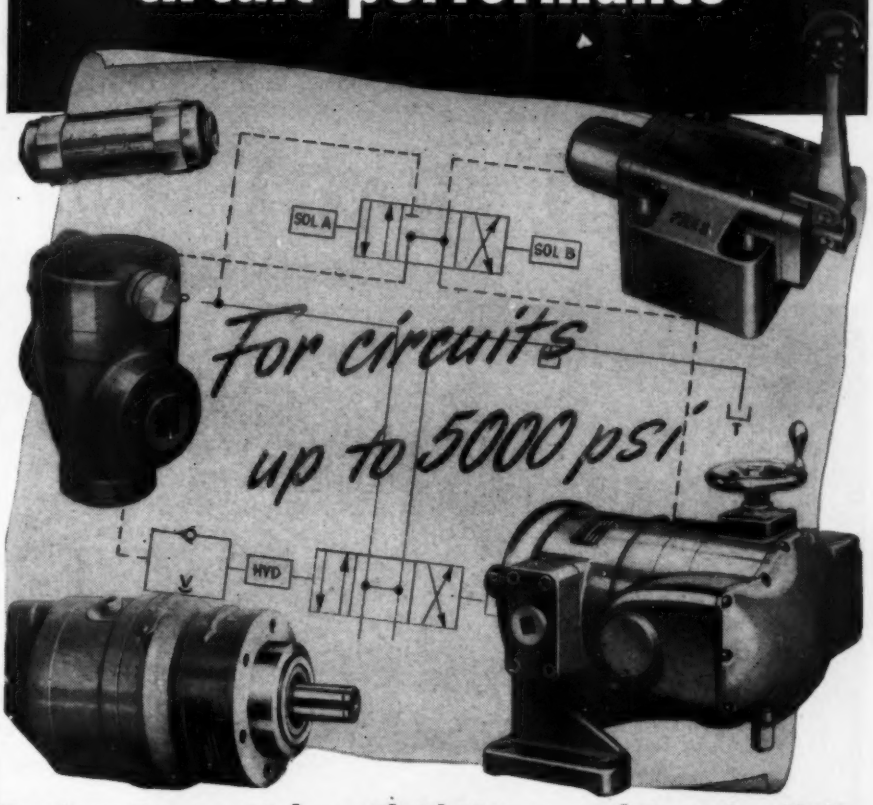
For the sixth year, the ASM Metallographic Exhibit will be a feature. A large area in one of the Exposition buildings has been reserved for entries in a dozen different classifications.

Three Top Awards

The three top awards will be presented at the annual ASM dinner on Thursday, October 18. The Albert Sauveur Achievement Award, established by the ASM in 1934, will be presented to Dr. Robert F. Mehl, Head, Department of Metallurgy, Carnegie Institute of Technology, Pittsburgh. The Award is a recognition of pioneering metal achievements which have stimulated organized work which has resulted in a basic advance in metallurgical knowledge. The ASM Gold Metal, established in 1943 to recognize outstanding metallurgical knowledge and exceptional ability in the diagnosis and solution of diversified metallurgical problems, is to be awarded to Dr. Paul D. Merica, Executive Vice President, International Nickel Company, New York. The third major award, the ASM Metal for the Advancement of Research, will go to Gwilym A. Price, President, Westinghouse Electric Corporation.

W. H. Eisenman, Secretary, American Society for Metals, is managing director of the National Metal Congress and Exposition and the World Metallurgical Congress.

Planned for BETTER circuit performance



Denison Pumps, Valves, Fluid Motors and Pumping Units

Users get quick proof of highest efficiency when they pick Denison components for their hydraulic circuit needs. Advanced engineering features readily prove their *extra value* in actual performance. Simplified design results in fewer parts, less wear, lower cost, and more compact design. Denison Hydraulically balanced pumps and controls give maximum performance for the heaviest jobs.

PRESSURE CONTROL VALVES, in relief, sequence and unloader types. ¾", 1¼" and 1½" sizes. Surge damping controls for both aircraft and industrial systems.

4-WAY VALVES — with manual, mechanical, hydraulic or electric control, including new pressure-centered single and double solenoid types for positive control to 5000 psi. ¼" to 1½" sizes in most types.

PUMPS — in constant and variable volume types, for all circuit needs to 5000 psi.

FLUID MOTORS, in a wide range of models with capacities of 3 to 160 hp. Torque ratings to 5585 inch-pounds.

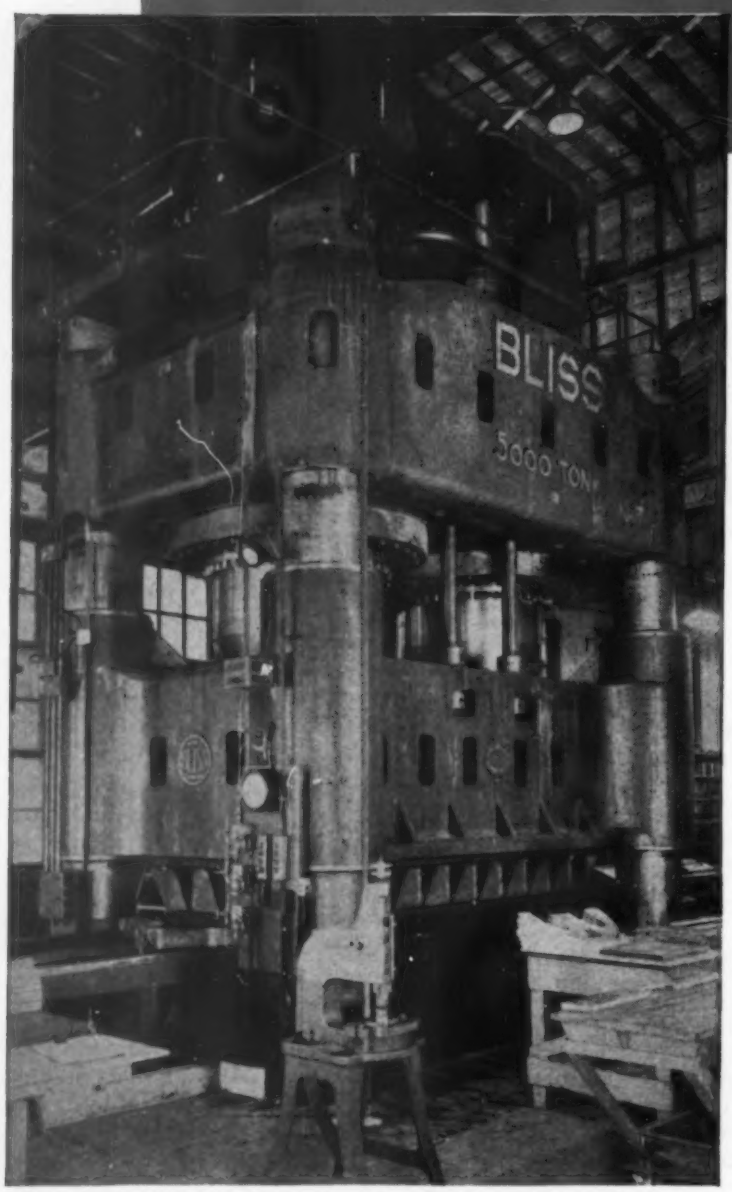
PUMPING UNITS — for constant and variable volume operation, with capacities ranging from 2 to 35 gpm. Packaged power built to JIC recommendations.

Write for complete information on Denison HydrOILic Equipment; also send for your JICircuit Guide and Template, described and illustrated on the opposite page.

The DENISON Engineering Co. 1166 Dublin Rd., Columbus 16, Ohio

DENISON
Hydraulic Equipment

3 YEARS... INITIAL FILL OF TEXACO REGAL OIL (R&O) STILL GOING STRONG



Three years ago Sikorsky Aircraft of Bridgeport, Conn., installed this 5,000-ton Bliss press. Initial fill of hydraulic fluid was *Texaco Regal Oil (R&O)*—still in as fine condition today as when it went on the job. Moreover, the system is completely free from rust and sludge, and there has never been any trouble due to foaming.

Texaco Regal Oils (R&O) assure every hydraulic user these benefits because they're (1) turbine-quality oils, (2) made from choicest base stocks, and (3) fortified with rust and oxidation inhibitors and specially processed to prevent foaming.

Thus, *Texaco Regal Oils (R&O)* are *more than 10 times as resistant to oxidation* as ordinary turbine-quality oils and afford longer lasting protection against rust and foam. *Texaco Regal Oils (R&O)* are approved by all leading hydraulic manufacturers.

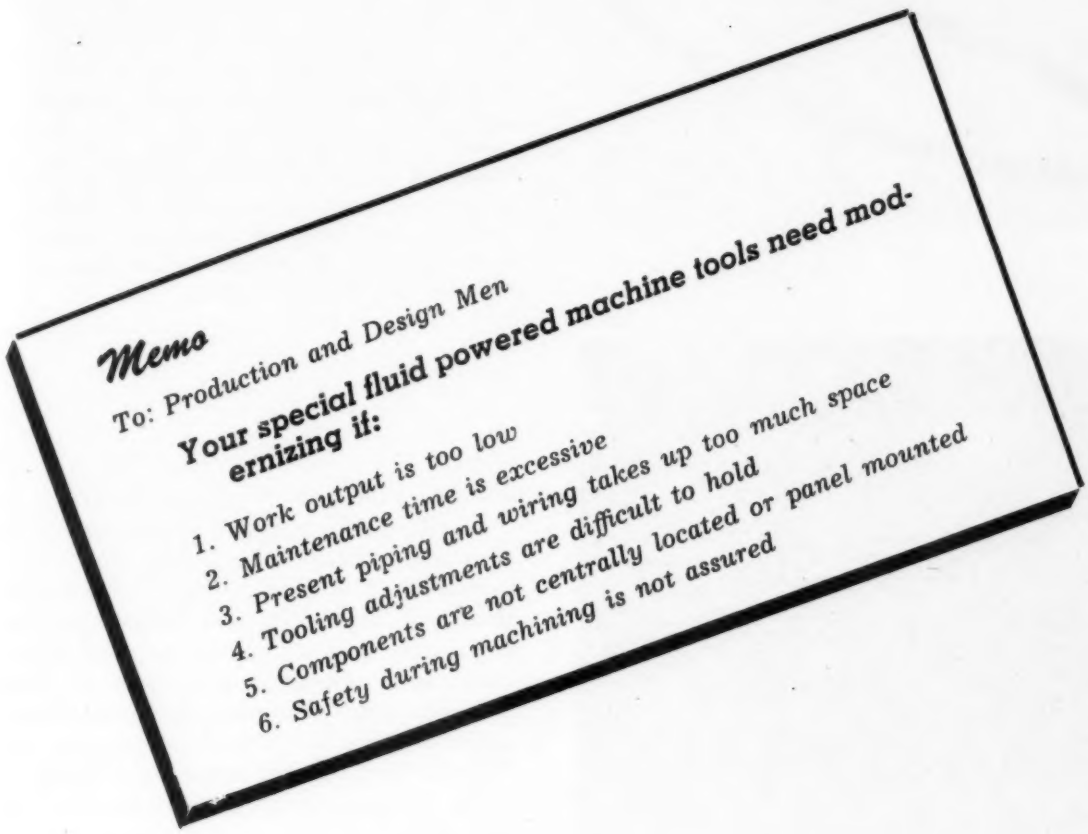
Talk to a Texaco Lubrication Engineer and get the facts on how you can improve hydraulic efficiency and reduce your costs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS


Memo
To: Production and Design Men
Your special fluid powered machine tools need modernizing if:
1. Work output is too low
2. Maintenance time is excessive
3. Present piping and wiring takes up too much space
4. Tooling adjustments are difficult to hold
5. Components are not centrally located or panel mounted
6. Safety during machining is not assured

Packaged Controls

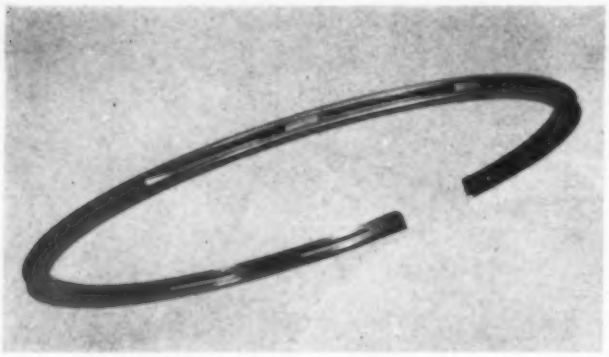
simplify piping problems in redesign

By ALLEN BRADRICK

EARLY IN THE POST WAR ERA THE McQUAY-Norris Manufacturing Company began an intensive program of equipment modernization. This program has continued to the present time on an ever increasing scale, and embraces a more extensive use of carbide tipped milling cutters and circular form tools together with the necessary automatic machines for their fullest utilization.

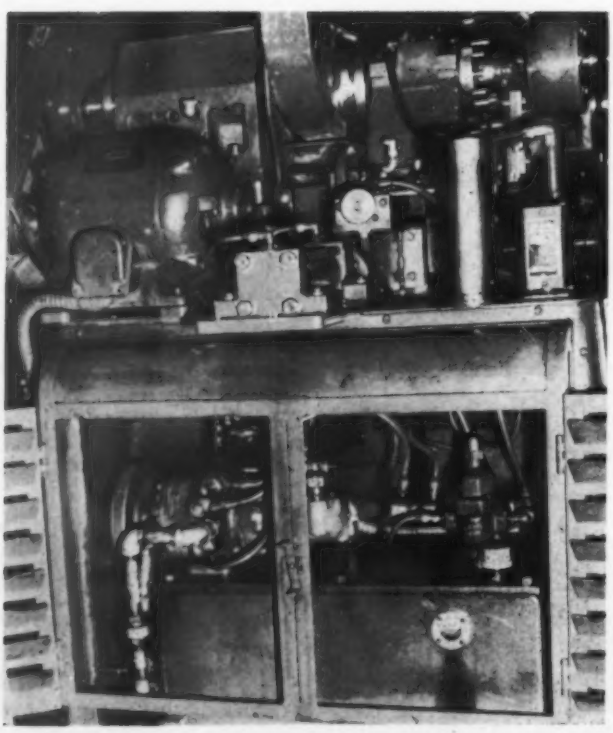
As in many specialized industries, very little of the required machinery can be purchased ready-made, but must be tailored to suit, as dictated by the current or prospective methods to be employed. Such tailoring may extend from minor tooling on some standard machine tool, to designing and building a spe-

Allen Bradrick is Assistant Chief Engineer with McQuay-Norris Manufacturing Co.



THE JOB requires milling of oil ventilating slots. Piston rings are to be ganged on an arbor, fed into a circular saw and indexed until all slots have been cut.

THE MACHINE uses a hydraulic clamping and work feeding system. Front view shows the hand valve for controlling the clamp cylinder. Two bleed off valves are used only for setup. Limit switches automatically sequence the feeding and index system. Rear view shows the compact oil system in the machine base and the feed cylinder mounted on top.



cial machine from the ground up.

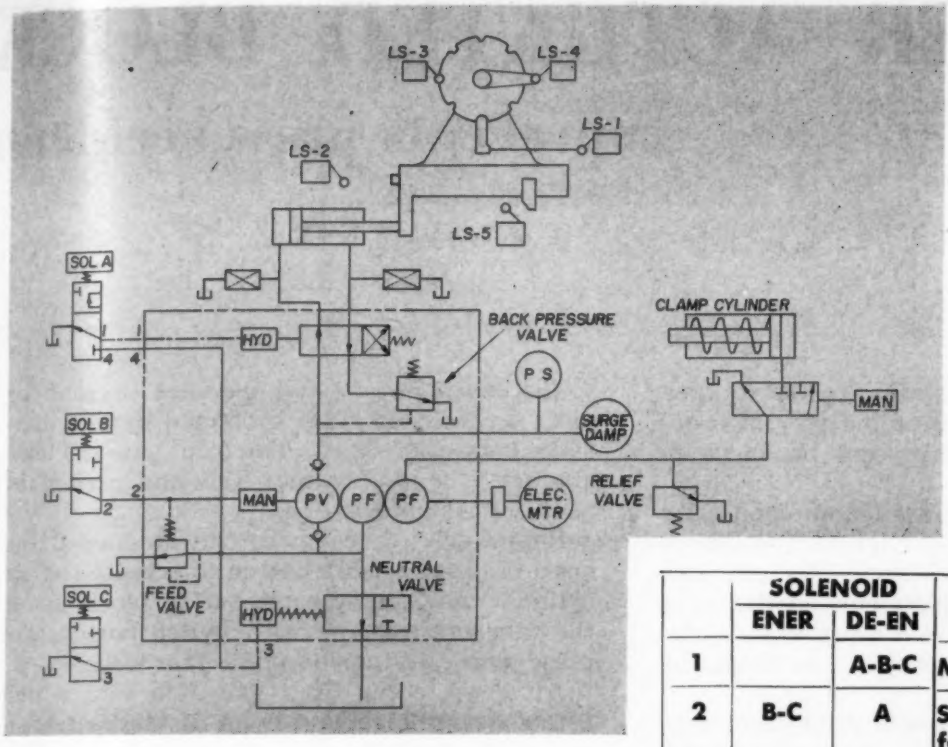
In this latter respect, it was decided to concentrate almost exclusively on hydraulically operated machines. This decision was influenced largely by the factors of flexibility, reliability and simplicity as compared to mechanically operated machines of equivalent performance. Despite difficulties caused by unfamiliarity with hydraulics, we have had little or no cause to regret this decision.

An interesting machine from the hydraulic standpoint is one we refer to as a '49 Model Ventilator. It is an automatic hydraulic milling machine for gang milling the oil ventilation slots in piston rings. It was designed to replace an earlier model. We incorporated a simplification of controls and an overall improvement in appearance.

The earlier machines took up excessive floor space, were difficult to keep clean and were crude in appearance due to the maze of pipes and wires connecting the hydraulic power unit with the machine proper. This situation is corrected in the '49 Model by mounting all the hydraulic components in, or on the base casting of the machine itself. An accumulator and check valve formerly used to maintain pressure in the clamping cylinder during the rapid traverse cycles were replaced by an auxiliary pump built into the housing of the main pump.

In the older model, it had been necessary to install heater elements on the hydraulic tank to maintain a uniform oil temperature in order to be sure of having a constant cycle time especially on cold mornings. This condition is now avoided by using a piston type pump for the feed portion of the cycle.

On the '49 model a single control for size change adjustment is obtained by mounting the stroke reversal limit switch LS-2 and the controlled feed switch LS-5 on the same bracket, so that they always maintain the same rel-



THE CIRCUIT has been greatly simplified by the use of a package unit which includes the pumps and valves shown within the dash lined housing. The three solenoid valves are also mounted as one compact unit.

	SOLENOID		OPERATION
	ENER	DE-EN	
1		A-B-C	Machine Stopped
2	B-C	A	Start button starts rapid forward
3	C	A-B	LS-5 starts feed
4	A-C	B	LS-2 starts rapid return
5			Mechanical index on return
6	B-C	A	LS-1 starts forward travel
			Cycle repeats thru all index stations.
7	A-B-C		At end of machining LS-3 holds sol. A ener.
8	A-B	C	PS unloads pump to stop operation, permitting unloading of parts

ative position to each other. On the older model, it was necessary to adjust both the limit switch and the deceleration valve cam independently. Failure to set either properly could result in a wreck.

An additional safety factor is the incorporation of a pressure switch in the circuit having a setting just above that of the normal operating pressure. Thus, the whole circuit is put into neutral by anything causing an abnormal pressure rise.

Operation of the New Machine

On the new machine, the work-head actuator is a commercial hydraulic cylinder, while the clamping cylinder was designed and built here at McQuay-Norris. Only two valves are required, one is a 3 way manual valve for the clamping cylinder and the other is a triple solenoid pilot valve.

A group of piston rings are positioned and clamped to the work spindle face plate in the closed state by means of a clamping plate and drawbar actuated by a hydraulic cylinder at 400 psi. This produced approximately 10,000 pounds drawbar pull which is sufficient to enable the rings to resist the lateral thrust produced by the infeed of the milling cutters. The operator initiates the machine cycle by pressing the "cycle start" button which is a remote station push button with two pair of normally open contacts and one pair normally closed. Depressing the "start" button simultaneously energizes solenoids "B" and "C" of the solenoid pilot valve, through relays. Energizing pilot valve "C" blocks line 3, shifting the neutral valve spool from neutral to active. Pilot valve "B" now blocks line 2, causing the piston pump charging valve to seat, and forcing all the oil from the rapid traverse pump to pass through the piston pump to the 4-way valve and then to the rod end of the cylinder, bringing the workhead forward in rapid approach.

Just before reaching the cutters, a cam on the work slide contacts and opens a pair of N.C. contacts in LS-5. This switch is in the

(Continued on page 82)

CYLINDER ACTUATED BLOCK

prevents press accidents

DEVISING AN EFFECTIVE PRESS GUARD TO KEEP operators hands out of the way of a descending ram is an everpresent headache to tooling and safety men.

Progressive dies which are fed automatically by coil feeders give the tool engineer the chance to fully enclose the work area. For operator safety, when making adjustments on the press tools, the protection device must work automatically without any specific care from the operator.

Here's how the tooling and production men at Thompson Products, Inc., Cleveland, changed a hazardous press guard to one which avoids any possibility of "human error".

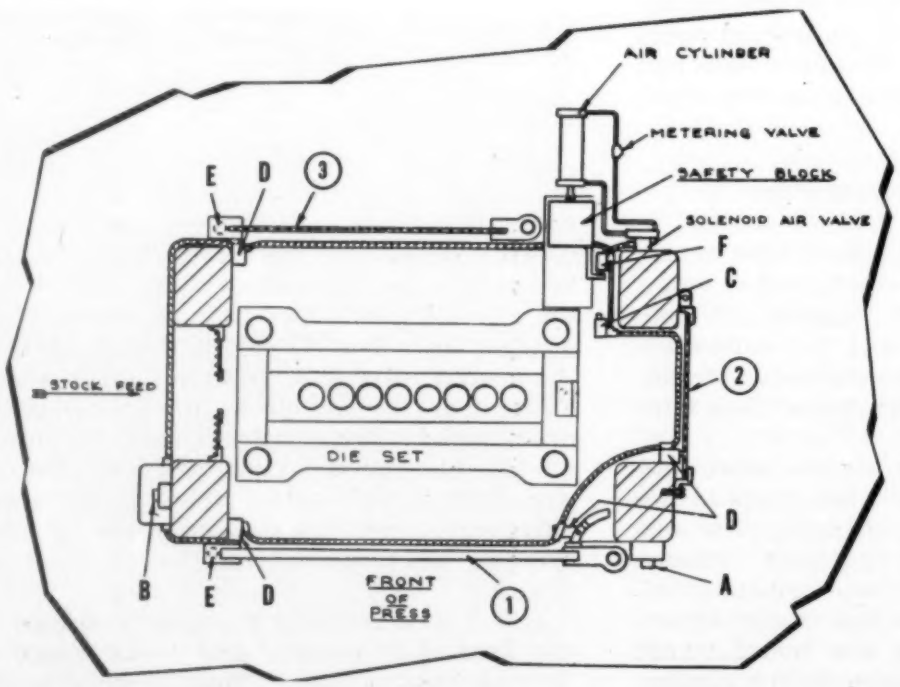
The new guard has all openings (except for a slit on the feed side) protected by automatically controlled doors. The front gate is Plexiglas set in a steel frame. Side and rear gates have screen inserts.

Before any of the gates can be opened the operator must push a button to actuate the air cylinder which moves the safety block under the ram and trips a micro switch cutting the press power and opening the gate locks.

Attached to the front gate is a cam which passes over the contact point of the switch on the right side when the gate is opened. This prevents tying down the left side switch and working with the gate open.

NEW METHOD for safe adjustment of press dies:

First press stop button (A)
Then press safety block operation button (B)



This actuates the solenoid valve and pushes the steel block in beneath the ram.

The block opens microswitch (C) which cuts the press power and releases the lock switches (D) on all gates (1, 2, 3).

The lock switches release the pins (E) permitting the gates to be opened.

Before the press can be started up again, all gates must be shut.

Then the block can be automatically withdrawn. In the "out" position, the block contacts a microswitch (F), permitting the drive motor to start.

PRE-REGISTRATION

National Conference on Industrial Hydraulics
Sherman Hotel, Chicago, November 7-8, 1951

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All registrants will automatically receive Volume V, Proceedings of the Conference as soon as it becomes available. Proceedings will contain the complete text of all technical papers presented.

Seventh NCIH To Attract Record Attendance

THE SEVENTH ANNUAL NATIONAL CONFERENCE on Industrial Hydraulics which will be held at the Sherman Hotel, Chicago, on Wednesday and Thursday, November 7 and 8, is preparing for a record attendance. The attendance has increased each year and this year, sectional meetings, inaugurated last year, will again be held. Conference director John S. Slomer, hydraulics department, Goodman Manufacturing Company, announces that the program is virtually complete.

Sponsored by the graduate school of Illinois Institute of Technology and Armour Research Foundation of Illinois Institute of Technology, the Conference has attracted an increasing number of industrial and aviation hydraulic executives and technical men each year.

Because of the heavy anticipated registration, it is urged that early registration be made. The attached form is printed for convenience. Prompt reservations at the Sherman Hotel or nearby hotels is also suggested.

By COLE H. MORROW

FLUID TRANSMISSIONS,

the key to high stoker efficiency

HYDRAULIC DRIVE UNITS WERE INSTALLED ON the fuel feed and grate drives of the stoker on the 100,000 pound per hour boiler unit installed in our Tractor Works Power Plant. This boiler started in operation in December, 1949, and recent tests conducted by Battelle Memorial Institute proved the unit to be one of the highest efficiency installations in the country if not the highest. Efficiencies obtained under normal operating conditions ran as high as 92 per cent.

Application of hydraulic drives with their variable speed characteristics contributed materially to making the high efficiencies possible. Close control of fuel feed and grate speed in direct proportion to the air flow over a wide range of operating conditions is essential to obtain high efficiencies. The hydraulic drives have been a very satisfactory solution to this problem. Most boiler control systems do not operate satisfactorily beyond about a four to one range, i.e., a 100,000 pound per hour unit would not be expected to operate under automatic control below 25,000 pounds per hour. This is really not a limitation by the control system but rather the various drive

Cole H. Morrow is chief plant engineer at the J. I. Case Company, Racine, Wisconsin.

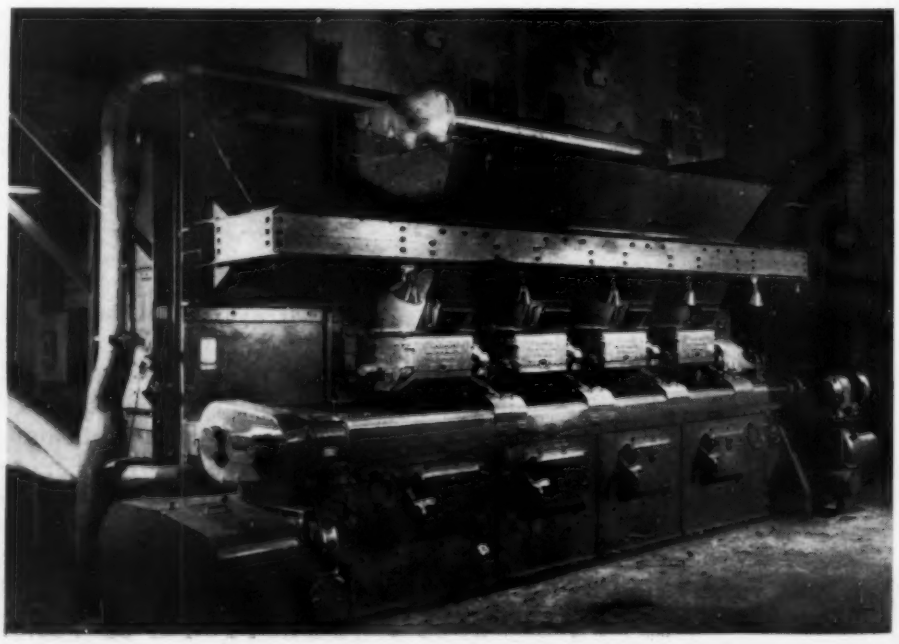

Fig. 1. Three-quarter front view of the Detroit Roto-Grate Stoker in the power house of the Tractor Plant of the J. I. Case Co., Racine, Wisc. Both fuel feed and grate travel are driven by constant and variable displacement motors driven by variable delivery pumps.

Advantages of Fluid Transmissions:

- ✓ **Precise automatic stepless control from low to heavy loads.**
- ✓ **High efficiency—power used only in proportion to the work performed.**
- ✓ **Automatic overload protection.**
- ✓ **Direct connection to standard speed electric motors.**
- ✓ **Positive speed practically unaffected by load variation.**
- ✓ **Flexibility of control.**

units which the system controls will not operate precisely and accurately over a wider variable speed range.

In our installation we use variable delivery hydraulic pumps whose output is regulated by the combustion control system. These pumps supply constant displacement hydraulic motors installed on the fuel feed and the grate drives. This hydraulic drive arrangement enables us to obtain smooth, positive and precise variable speed operation from 0 to 100 per cent capacity of the fuel feeding equipment, and the speed control characteristic is a straight line which makes it possible to calibrate the control system for operation within amazingly close limits of fuel air ratio variation and to obtain automatic operation over a load range as high as 20 to 1. Theoretically, the control system and hydraulic drive arrangement is capable of operating from 0 to 100 percent of the boiler unit capacity, but due to operating limitations this entire range cannot be utilized. We have actually operated the 100,000 pound per hour unit at loads of from 5000 to 7000 pounds per hour under full automatic control for long periods of time with no difficulty whatsoever. This seems almost amazing when compared with drive arrangements previously used which in our case would probably limit automatic operation to a minimum of 20,000 to 25,000 pounds per hour.

On a traveling grate spreader stoker such as we have, it is essential that the grate speed be varied directly with variations in fuel feed if maximum efficiencies are to be obtained. With the hydraulic drive units we are able to obtain synchronized grate speed and fuel feed

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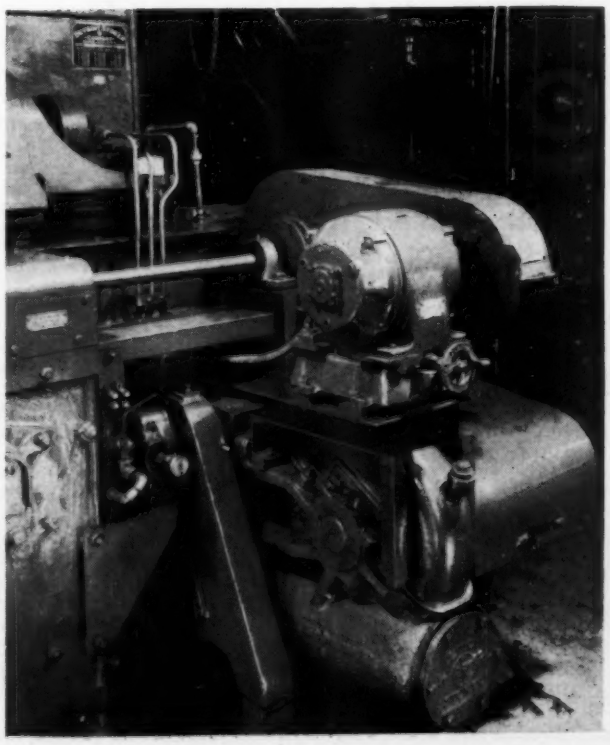


Fig. 2. Close up of the drive motors. The upper unit is a constant displacement motor which drives the fuel feed mechanism. The lower unit is a variable displacement motor which drives the right-hand half of the grate. This motor is connected in series with a constant displacement motor which drives the left-hand half of the grate.

Photos courtesy the Oilgear Company.

Efficient production of this extruded product depends on the ease of changing dies, their safe and rigid clamping, and smooth, fast cycling of the main extruding ram.

Internal Ram Design Speeds Extrusion

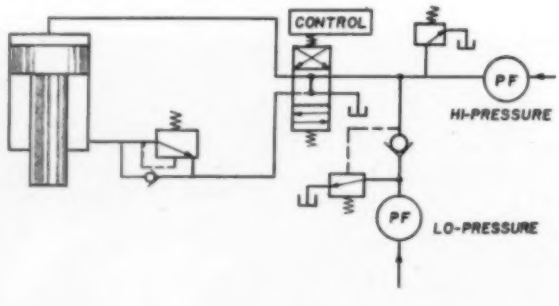
. . . of phos-copper rod ribbon

SELECTING A SYSTEM FOR RAPID ADVANCE OF a press ram is dependent upon desired speed, tonnage, and specific application. This Baldwin 500 ton extrusion press, used in the manufacture of phos-copper rod ribbon at the Buffalo Works of Westinghouse Electric Corporation, uses internal ram design. The large volume of oil needed to speed the movement of the 22½ in dia main cylinder through its 15 in stroke demands the use of a prefill valve, thereby eliminating the possibility of using two of the four speed control methods shown on these pages.

Choice between the use of a kicker (booster) cylinders and an internal ram was largely determined by the press application. Since clamping the die and dummy block is performed by two 10 in dia cylinders, as seen in Figure 1, space limitations preclude the use of kicker cylinders. To provide fast approach, the main cylinder is bored to accommodate a 5¾ in

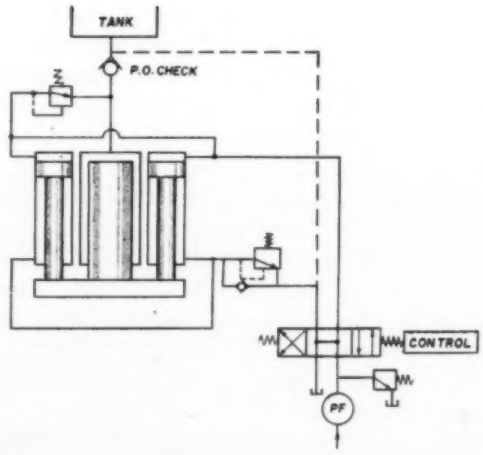
(Concluded on page 77)

Methods For Obtaining Fast Pr



Most press operations only require high pressure for a small part of the work stroke and low pressure, high volume for a rapid advance. Presented here are four basic methods for providing these requirements.

1. Two pump system—A large volume, low pressure pump for rapid traverse is combined with a small capacity high pressure pump. At maximum low pressure the unloading valve opens to dump the full capacity of the low pressure lines. In operation, the ram is moved rapidly by oil supplied by both pumps until the work is contacted and pressure builds up to unload the high volume pump. The squeeze operation is performed by the high pressure oil. A back pressure valve prevents dropping of the ram due to gravity.



2. Prefill system and kicker cylinders—To increase the speed of a ram oil delivery must be stepped up or ram area decreased; therefore for very high speeds a double pump system becomes unwieldly. A "prefill" or "surge" system is quite efficient. Rapid advance is accomplished by means of small kicker cylinders while the main ram prefills through a valve from a surge tank.

When the platen meets the work, pressure builds up to operate a sequence valve (usually built into the prefill valve) causing the prefill valve to shut

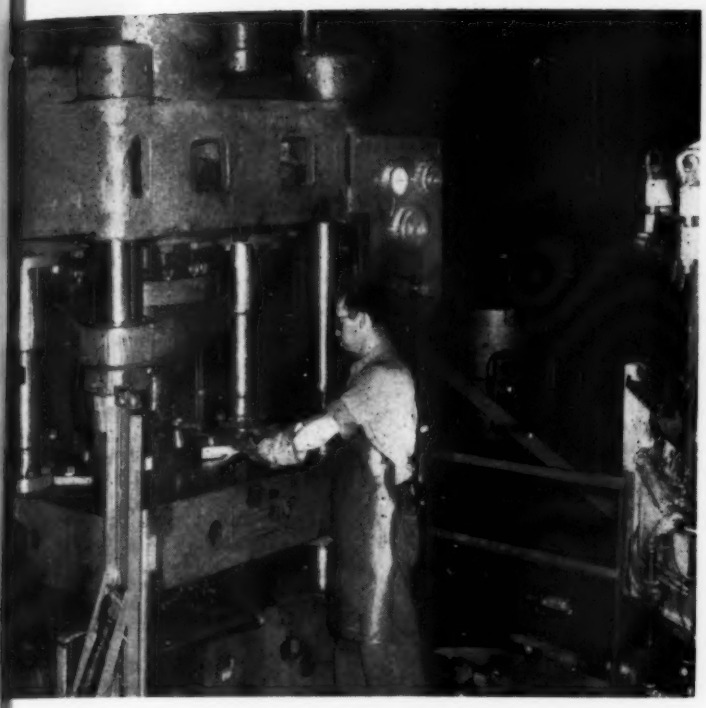


Fig. 1. With extrusion dies safely positioned and clamped the operator transfers a preheated slug of phos-copper from the furnace to the dummy block below the punch. Action of a foot pedal starts the punch downward to extrude the slug through the die. A pressure control relief valve on the panel is used to regulate tonnage.

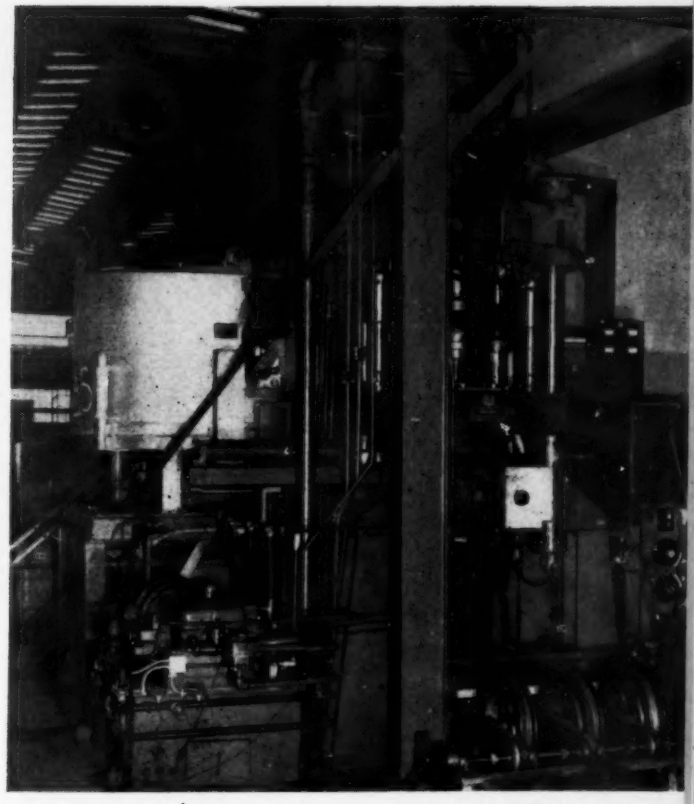
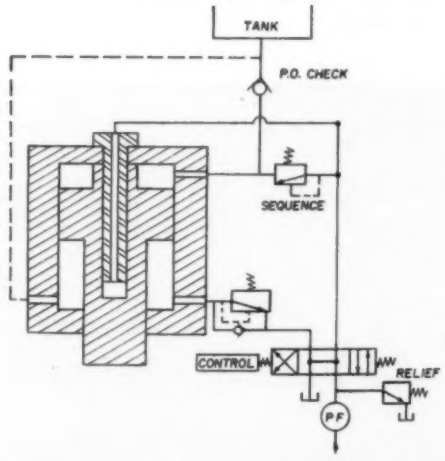
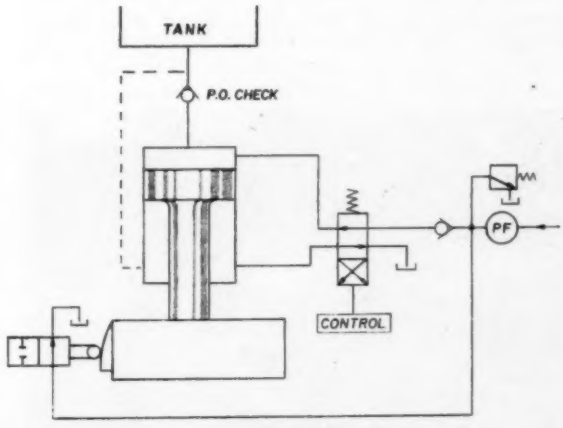


Fig. 2. At the rear of the press, the finished phos-copper wire is wound on reels. The press hydraulic system is at the left. The horizontal cylinder, seen at the side, moves a sliding table to facilitate installation of the 500 pound die and dummy block assembly. Oil is delivered to the main ram during rapid approach, through the large prefill valve at the top of the press.

Fast Press Ram Approach





off flow from the surge tank and admit pressure oil to the main cylinder for the high force squeeze operation. Pressure applied to the rod end of the kicker cylinders opens the prefill valve so that the platen returns at higher speed discharging oil from the main cylinder back to the surge tank.

3. Prefill system with internal ram—This system is used where space limitations make kicker cylinders impractical. Rapid traverse of the ram on the Baldwin 500 ton press used in the application described here is accomplished with an internal ram. The prefiill system operates as previously described. Boring out the main ram and fastening a rigid ram at the top provides a reduced area for oil to act on. When the work is met, pressure builds up to operate the sequence valve admitting pressure oil to the large area of the main ram.

4. Gravity rapid traverse—When the weight of dies on the ram is sufficient to overcome friction forces, the kicker cylinders are eliminated and rapid traverse is accomplished by gravity. The back pressure valve must also be eliminated. However, the 4-way control valve can no longer be a three position open center design, because with this valve in neutral the ram would fall. A two position valve is used and the check valve traps oil to hold the ram up while pump volume returns to tank through the two way cam operated valve.

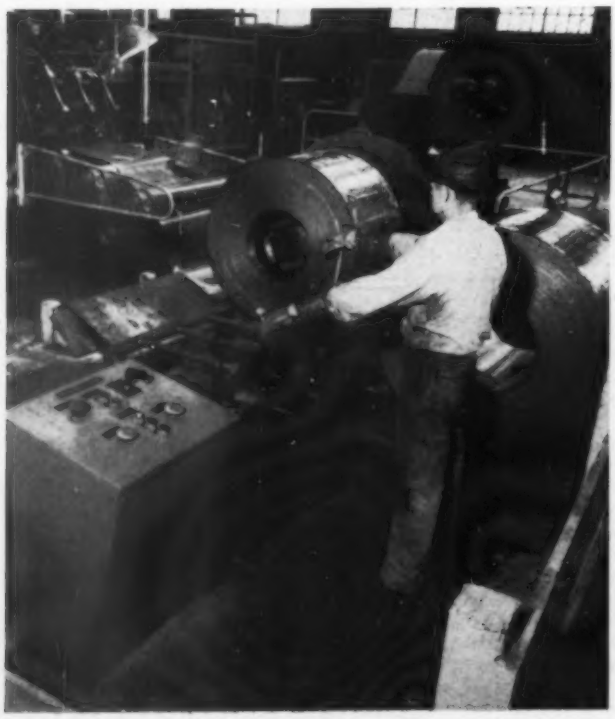
Trim Line Uses SERVO Edge Control

ONE OF THE PROBLEMS ON ANY TRIM LINE IS to maintain a uniform edge. When material is streaming through the cutters at 3000 fpm, a system for edge control must respond quickly and accurately.

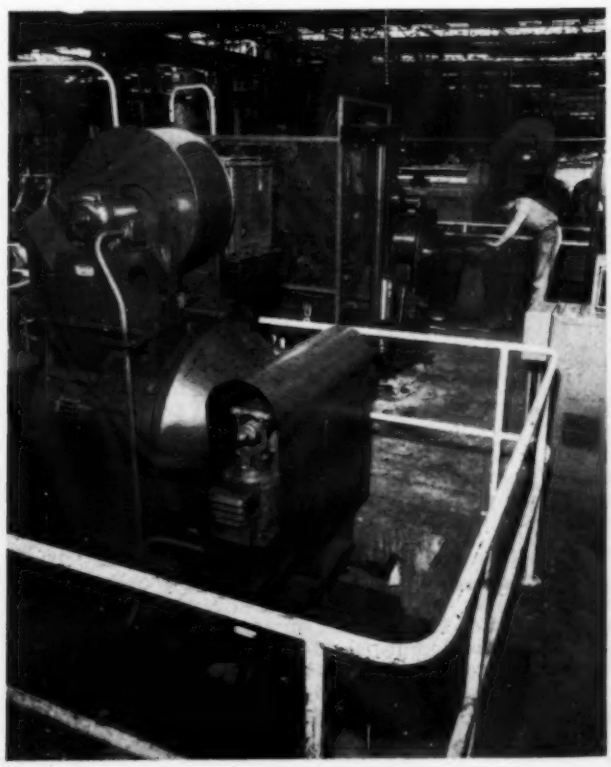
In a trim line of an eastern steel producer, Westinghouse Electric Corporation solved this control problem with an electro-hydraulic servo system.

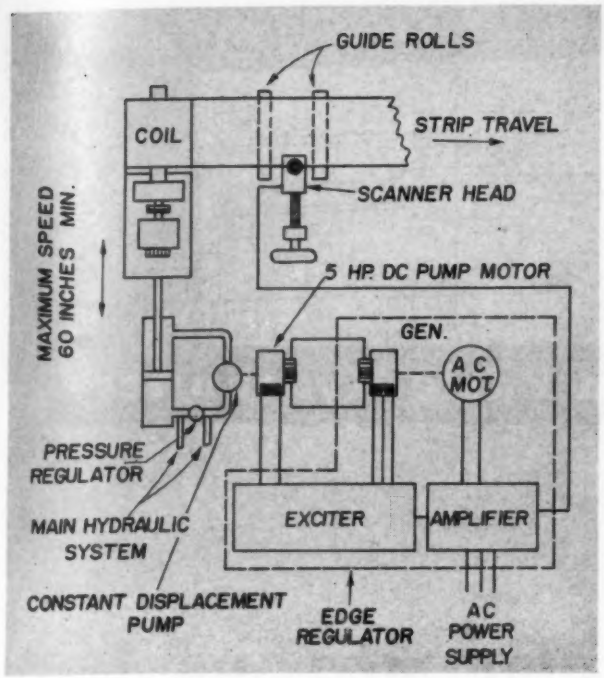
The principle of operation is quite simple. Strip travels through a scanner head located at the strip edge. Any shift, or error, in the edge changes the amount of light to the scanner. This signal change is fed through an amplifier to excite the fields of a generator. Polarity of the two generator fields is determined by which field becomes strongest. Change in polarity determines the direction of hydraulic pump rotation in the simple closed hydraulic loop. A hydraulic cylinder, actuated by oil from the pump shifts the coil to maintain the correct edge position.

1. At the entry end of the trim line a coil is being placed on the pay-off reel mandrel. From his station, the operator controls the line which will handle coils having a maximum weight of 15,000 pounds and a maximum diameter of 54 inches. Rated strip speed is 3000 fpm.



2. Looking toward the winding reel, at the drive side of the line. In the foreground is the pay-off reel motor, next the side trimmer motor with direct coupled speed indicating generator, and in the background the winding reel. The piston of the pay-off reel assembly positioning cylinder can be seen at the bottom of the pit in the foreground.



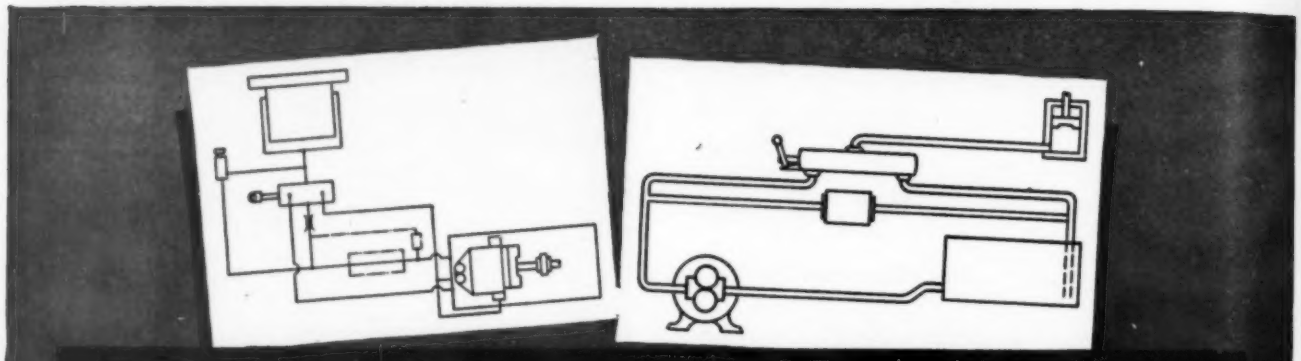


3. Schematic of the edge control system which is designed to maintain the edge of the strip within plus or minus 1/32 in, based on a maximum variation of one inch movement of the strip position in 50 ft of longitudinal travel. Error in edge position produces a change of signal from the scanner head to the motor-generator set in the edge regulator control. Hydraulic pump rotation responds to the regulator, and provides pressure oil to the cylinder to shift the pay-off reel assembly.

4. The hydraulic system, with the d.c. driving motor for the edge regulator in the center. This motor drives the hydraulic pump which shifts the entire pay-off reel assembly to keep the strip properly positioned in the line. Other operations in the line which are controlled by pressure oil from this system include actuation of pay-off and winding mandrels and cylinders for the handling of coils.

5. Heart of the servo system is this regulator control with the motor-generator set in the bottom of the housing. This housing has a motor driven blower with renewable type air filter to keep it pressurized both for ventilation and the exclusion of dirt. At the right is a hydraulically powered welder set up in line for splicing.

6. Closeup of the entire pay-off reel drive which is moved by the hydraulic cylinder mounted below the drive motor. The stand can be moved at a maximum speed of 60 ipm in either direction. Actual travel in operation is small, as the cylinder movement controlled by the edge regulator compensates for any variation in the stock width passing beneath the scanner.



A Beginner's Course in Basic Hydraulics

Chapter IX

ROTARY HYDRAULIC MOTORS

WORK OUTPUT IS THE END PURPOSE OF ANY hydraulic circuit. We develop the system to provide a required force or torque acting through a desired linear or rotary distance. This work is obtained at the output shaft of the hydraulic motor.

Reviewing briefly, the basic hydraulic system consists of a pump, control valves and fluid motor suitably connected by piping. Let us follow the transfer of energy: Electrical energy supplied to drive the pump is converted by the pump into hydraulic energy. Valves serve to control and direct this energy to the fluid motor which converts the hydraulic energy into useful work. When using a rotary fluid motor, the work or mechanical power output is expressed in torque and rotating speed.

The question immediately is asked, "Why not use the output of an electrical motor directly rather than feed it into a hydraulic system?" In answer, we can list some of the ad-

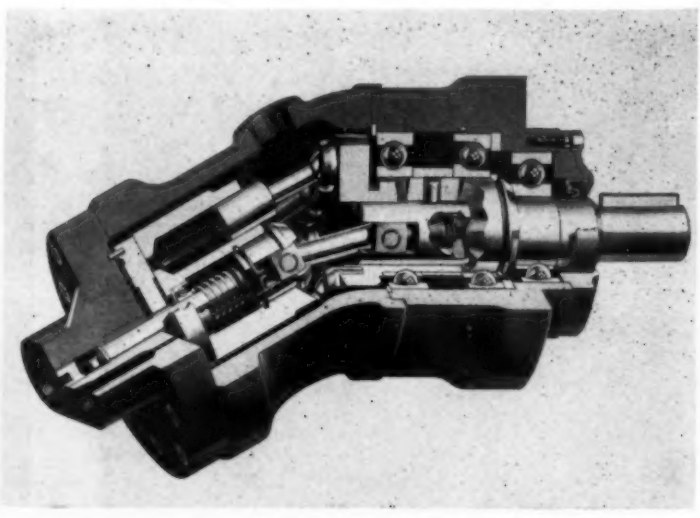


Fig. 1. This Vickers constant displacement axial piston motor provides constant torque with horsepower proportional to speed for a constant operating pressure. Torque efficiencies of 95 percent are attainable.

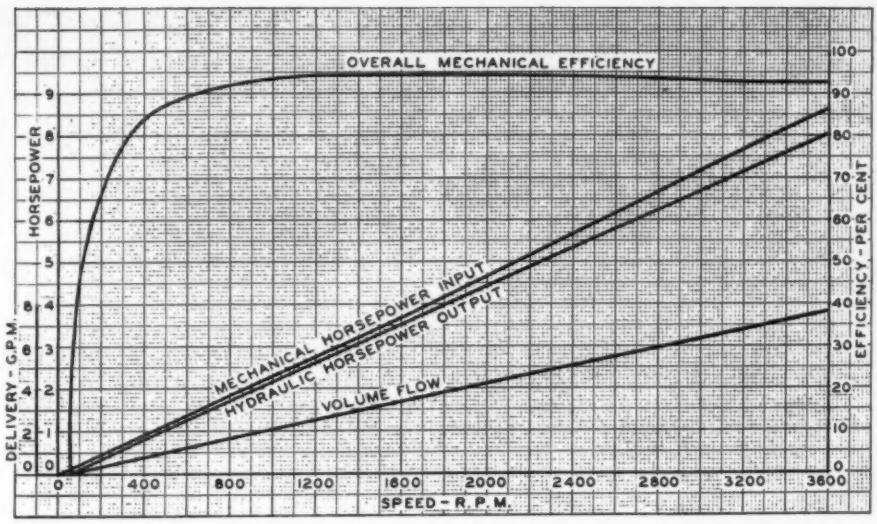


Fig. 3. Characteristic curves of a 9 piston hydraulic motor operating at a constant pressure of 1800 psi and temperature 150 F. Note that very low operating speeds for this particular motor are not attainable.

vantages of fluid motors which have led designers to select this power source over electrical motors for certain applications:

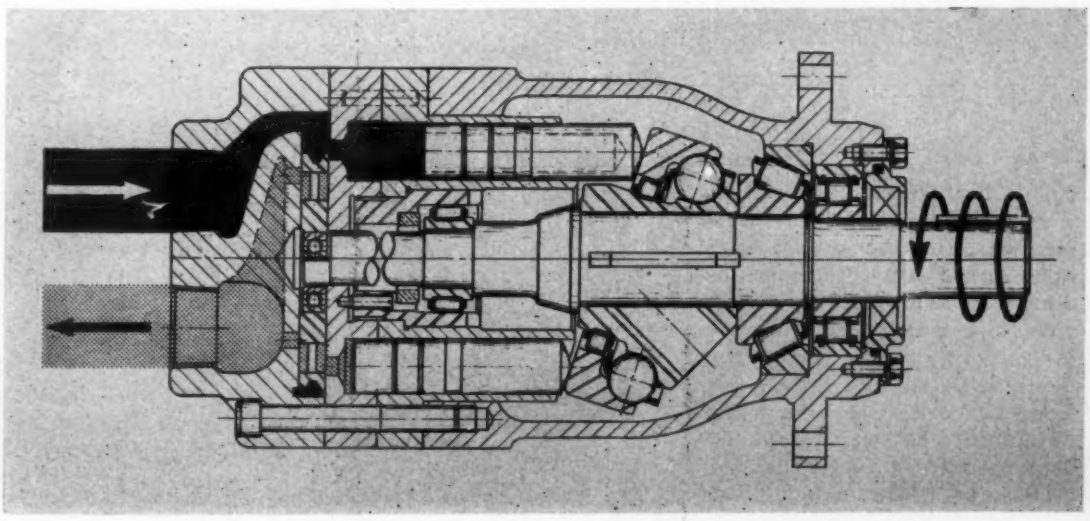
1. Extreme range of speed adjustment.
2. Compactness.
3. Fluid motors can offer larger ratio of horsepower to weight or space.
4. The presence of a hydraulic system already on a machine may make the use of rotary fluid motors for secondary functions practical.
5. Fluid motors will operate in explosive and corrosive atmospheres.
6. Fluid motors can be stalled under load without damage.

What devices may be used as rotary motors? Theoretically, most hydraulic pumps can be used as fluid motors by supplying pressure oil to the inlet port. This pressure oil acts on the pump elements converting its energy into mechanical power at the motor shaft. However, not all pump designs are directly convertible to efficient motors.

Many conventional spur gear pumps are too inefficient to operate as motors. A pump whose efficiency is under 50 percent will not operate as a motor because it is incapable of overcoming its own losses. However, there are several commercial gear motors designed with rugged bearings and methods for hydraulically balanc-

(Continued on page 70)

Fig. 2. Design of the constant displacement Sundstrand motor using a wobbler plate is shown. The thrust of the pistons is perpendicular and tangential to the plate. The resultant force is transmitted through bearings to the wobbler on the shaft and imparts rotating motion to it.



Can proper design of hydraulic systems eliminate the fire hazard at the hot metal end of die casting machines? Here is an effective design which provides for safe operation without the use of costly fluids or expensive corrosion proof components. This simple master and slave idea presents some intriguing possibilities for other oil powered applications.

DIE CAST SAFETY:

Circuit Design Reduces Fire Hazard

By JOHN W. PALMER

MOST DIE CASTING MACHINES USE HYDRAULIC oil under accumulator pressure to operate the shot function. A failure in the piping, fittings, or valves creates a potential atomized oil spray which will ignite upon contact with molten metal. Fire has been a serious problem confronting the machine builder—considerable thought has been given to reach the best method for minimizing this hazard.

In cooperation with design and operating personnel of a major automobile manufacturer, the Miller-Taylor Tool Company in Cleveland has developed a water actuated closed shot system. All control valves are kept on the oil side and therefore do not involve extra high cost for special material.

The heart of this system is a master oil cylinder directly connected to a master water cylinder which actuates a remotely located slave shot cylinder. While extremely simple in design, this circuit required careful construction because a preliminary study showed three possible shortcomings which would have to be avoided:

1. Would wash by the pistons in the water cylinder unbalance the strokes of driving and driven pistons?
2. Can a satisfactory arrangement be made for introducing the water soluble fluid in the closed system?
3. Could the supply and demand requirements of the shot cylinder be met?

A test setup was made and results indicated that construction of a complete machine was practical. The closed system is designed to use a master water cylinder having the same bore as the slave shot cylinder, while the master oil cylinder has a larger bore. It is felt that

John W. Palmer is chief engineer Miller-Taylor Tool Company, Cleveland, Ohio.

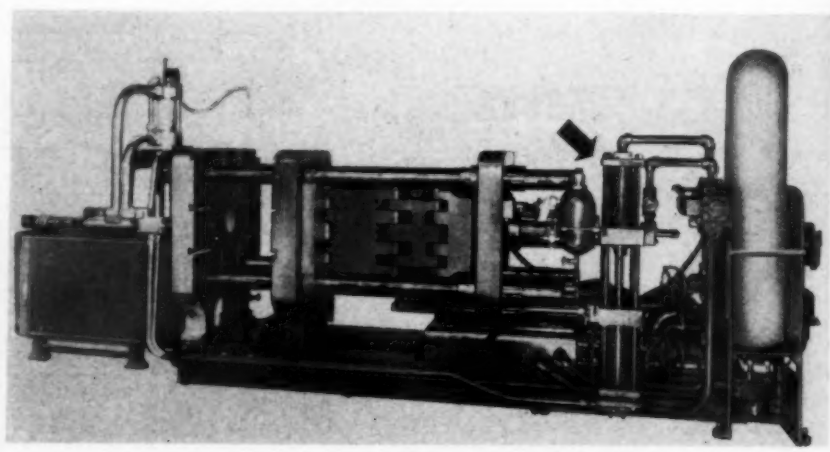
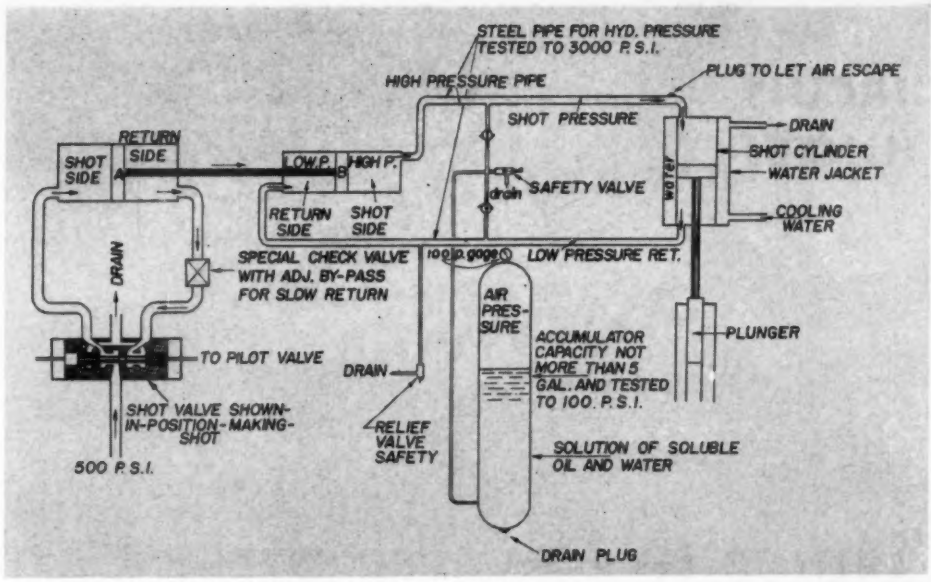


Fig. 1. Fire hazard at the shot end is minimized by the use of a water actuated closed shot system. At the right end of the machine the hydraulic system uses commercial valves and a petroleum base fluid to power the master oil cylinder, indicated by the arrow. A master water cylinder, below the master oil cylinder, delivers a water soluble solution to power the shot cylinder at the hot end.



Simplicity of the closed system for powering the shot cylinder is shown by the circuit.

this intensifier relationship between the master and the slave cylinders will quickly pay dividends in less leakage and longer pump life since the vane pumps used to charge the accumulator can now operate at a lower pressure.

Water leakage from the closed system at the hot end is only possible at the head and rod end connections to the shot and master water cylinders, and through the packing glands. Although slight leakage at these points is not harmful, a little care prevents leakage.

Water jacketing the shot cylinder cools the water soluble pressure fluid and has improved the life of piston rod packing which heretofore had required excessive maintenance because of operating above the hot metal pot. It has not been found necessary to use a water jacket on the master water cylinder.

Fig. 2. **HOT END** — No valving is needed to control the shot cylinder. Water soluble oil from the master water cylinder at the cold end circulates in a closed system. Note the positive limit switch control by cylinder tail rod.

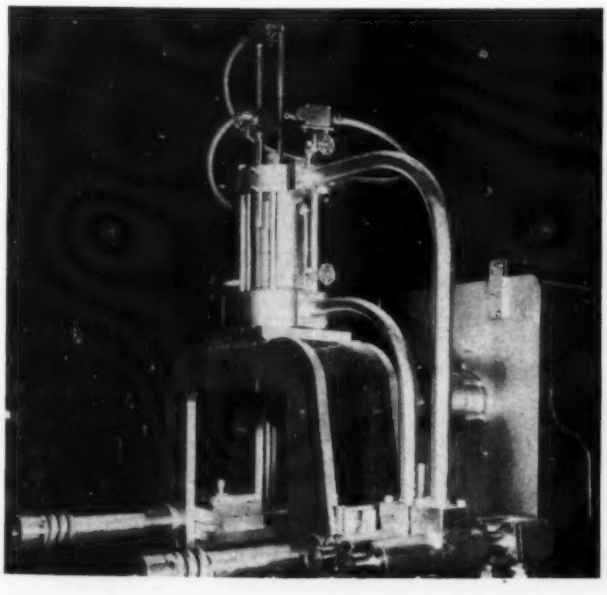
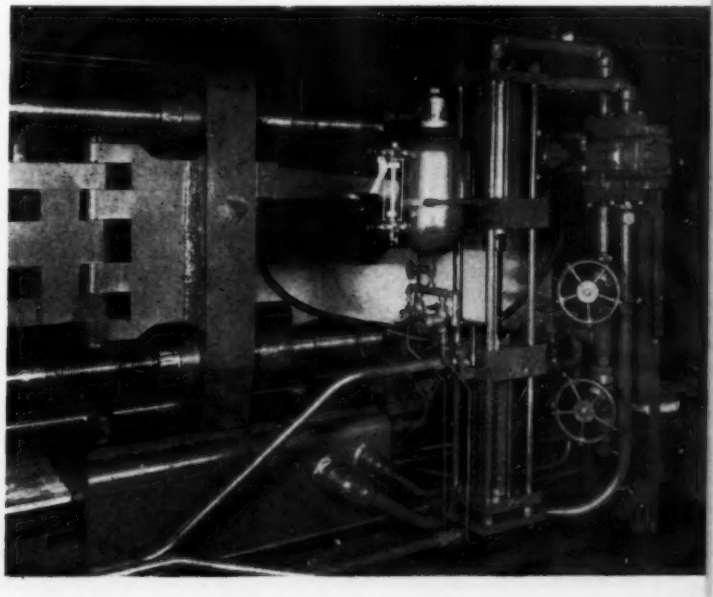


Fig. 3. **COLD END** — Close up of the master oil and water cylinders. The complete oil system is shown here. Oil and water cylinder pistons are directly connected. The small accumulator supplies make-up fluid to the closed water system.



CIRCUIT HINTS

Timer to Reverse Stroke and a Limit Switch to Unload Pump

By RUPERT P. ESSER

EVEN ON SIMPLE CIRCUITS WHERE VALVE ACTUation directs oil to clamp the work, move tools forward, return the tools and then unload the pump during idling, the designer has considerable flexibility in the choice of control systems. When he chooses to use solenoid operated valves to give automatic operation, the designer must then select the actuating devices.

Rupert P. Esser is chief engineer with TEC Engineering Corp., Logansport, Indiana.

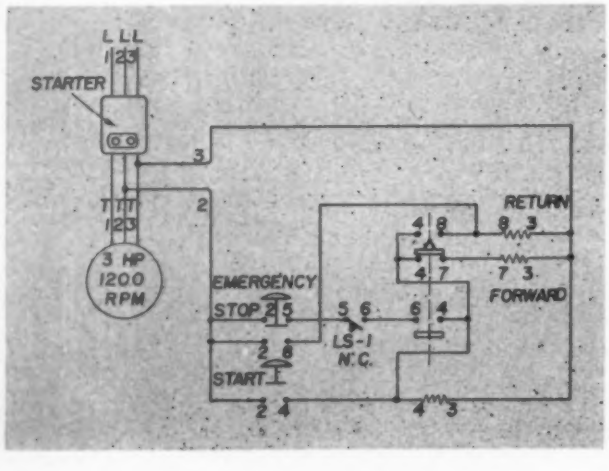
This group of "Circuit Hints" has shown methods of controlling simple, effective oil power circuits used on piercing machines. The first circuit, June issue, used a single solenoid, spring offset, two position, 4-way valve controlled by a timing relay and control relay.

In August, the circuit used a pair of 4-way, double solenoid, two position valves and a solenoid operated combination unloading and relief valve. Limit switches and timer controlled this circuit.

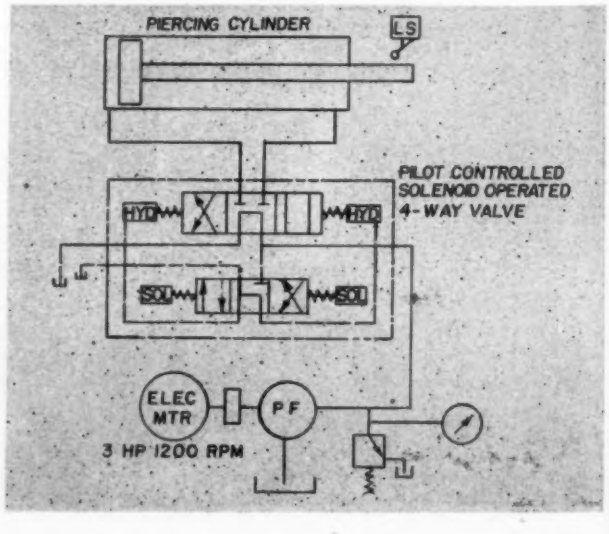
Two timers were used to control the revers-

(Concluded on page 78)

Electrical Circuit



Hydraulic Circuit



Could last winter's rugged blasts be headed your way again? Better be sure that your snow plow equipment is ready for another rough one.

The operation of the blade of this plow gives no concern to the owner. It is positioned and controlled by hydraulics — the hydraulic controls are COMMERCIAL. An abundance of power developed by this gear pump places smooth, fast, and accurate control of the blade at the operator's command at all times.

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RALPH E. MIDDLETON
Advisory Editor

MOCK-UP SAVES TIME

while providing realism to maintenance training

By RAY VAN COTT

A DETAILED MOCK-UP OF THE MARTIN 2-0-2 hydraulic system, built to save training time for maintenance as well as for flight crew personnel, is in operation at the Holman Airport maintenance base of Northwest Airlines, Inc. at St. Paul, Minn. In the three years the fully functional mock-up has been in operation hundreds of hours have been saved in the company's training program of maintenance operations.

The mock-up was built by Ray Leick, master

Fig. 1. Ray Van Cott, NWA instructor, explains the wing flap mechanism on the mock-up of a Martin 2-0-2 hydraulic system to two airline mechanics. The mock-up, complete down to the last detail, includes retractable wheels and wing flaps and a hydraulically operated passenger loading platform. The mock-up, in use for three years, has saved the company hundreds of training hours.

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mechanic and Ray Van Cott, instructor of hydraulic maintenance, Training Division. Arranged so that the relative locations of the valves, cylinders and other units of the mock-up are about the same as the locations on the actual aircraft, the unit has been valuable from the standpoint of trouble shooting the system as well as acquainting the mechanic with their location so that individual repair jobs can be done in a shorter time.

Some compression of individual component locations has been achieved in the interest of mobility. The entire mock-up is mounted on casters and can be moved about freely for maximum training efficiency. Two 24 volt direct current electric pumps, one the regular aircraft emergency pump and the other used as a substitute for one of the engine driven pumps, supply operating pressure. Some reworking of pressure regulating devices permit functioning at 900 psi instead of the 3000 psi the maximum pressure on the aircraft. Pressure gauges have been recalibrated to give the same indications as the full pressure would on the actual airplane.

Closed Center System

The mock-up or Martin 2-0-2 hydraulic system is composed of a closed center system and an open center system. The closed center system, in which pressure is actually stored and regulated, supplies pressure to:

1. Normal brake system
2. Emergency brake system
3. Nose wheel steering system
4. Windshield wiper system
5. Passenger loading ramp

The hydraulic system is arranged so that the closed center system has priority of pressure over the open center system; in the open center system the landing gear system has priority over the wing flap system.

The normal brake system has two brake metering valves which control brake pressure, shuttle valves to isolate the normal brake system from the emergency system and four single disc brake assemblies. These brake assemblies incorporate a self-adjusting feature which eliminates the need for making brake clearance adjustments.

Open Center System

The open center system, in which pressure is created only upon demand, supplies pressure to:

1. Landing gear extension and retraction system
2. Wing flap extension and retraction system

In the open center system the fluid merely circulates, after the pressure has been built up in the closed system, until such time as the landing gear or wing flaps need be operated.

The landing gear actuating cylinders extend and retract the landing gear through mechanical linkages. The landing gear is locked in both the "up" and "down" positions by mechanical latches. The latch is unlocked by the first movement of the actuating cylinder. The oil returning from the actuating cylinders holds the selector valve in either "up" or "down" position until the landing gear ceases to move, at which time a spring automatically

Fig. 2. The detailed mock-up is complete to the "instrument panel" in the "cockpit". The indicator (right, on panel) shows position of wing flaps (foreground). The mock-up is laid out as closely as possible to an actual system in an airplane, but compressed to save space and gain mobility.

Photographs courtesy Northwest Airlines, Inc.

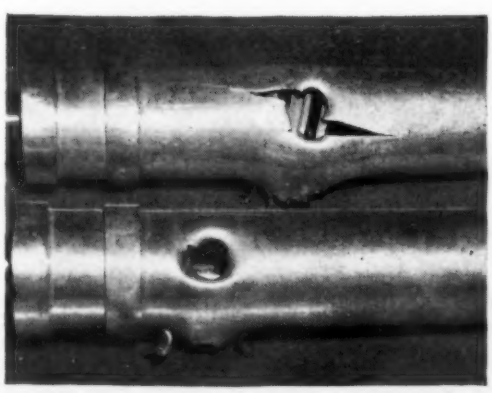
NOW . . . A COMPLETE LINE OF CYLINDRICAL ACCUMULATORS TO SPECIFICATION MIL-A-5498

Cylindrical accumulators designed to the latest proposed AN Envelope and which meet requirements of Specification MIL-A-5498, including winterization and ability to withstand gunfire, are now available from Bendix-Pacific, largest producer of aircraft accumulators.

At the suggestion of both the Air Force and the Bureau of Aeronautics, Bendix-Pacific has developed these accumulators, weighing approximately the same as the Bendix-Pacific spherical accumulators. With several models of cylindrical accumulators already in volume production Bendix-Pacific is now gearing for mass production of all sizes.

Listed below are the numbers which Bendix-Pacific has assigned to accumulators meeting the proposed envelope arrived at the April meeting of the SAE A-6 Hydraulic Committee. Other light weight models are also available.

Assembly No.	Air Capacity
551050-3	25 cu. in.
551050-1	50 cu. in. (small dia.)
551200-5	50 cu. in. (med. dia.)
551200-3	100 cu. in.
551200-1	200 cu. in. (med. dia.)
552200-1	200 cu. in. (large dia.)
552200-3	400 cu. in.



The ability of Bendix-Pacific cylindrical accumulators to withstand gunfire is evidenced by this unretouched photo. Fifty calibre incendiary ammunition was used.

Write for complete data and specifications.

Bendix

Pacific Division

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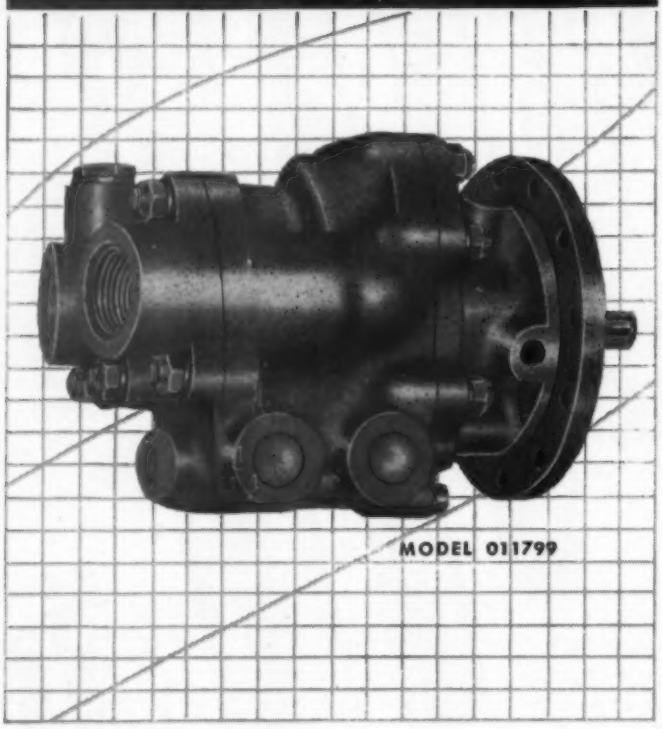
performance charts FIRST



UNLOADING GEAR-TYPE HYDRAULIC PUMP

- **High pressure—1500 p.s.i.**
- **High capacity—2 g.p.m. at 1500 r.p.m., at 1500 p.s.i.**
- **High volumetric efficiency—96% at 3000 r.p.m., 1500 p.s.i.**
- **High torque efficiency—90% at 3000 r.p.m., 1500 p.s.i.**

The unloading gear pump is designed to replace conventional variable volume pumps with these advantages: lighter weight, longer service life, lower maintenance expense, lower initial cost. This pump will unload up to 90% of rated flow, the remaining 10% being bypassed through a relief valve to obtain zero flow.

"Pressure Loading" provides automatic compensation for wear on the bearing and gear running surfaces and makes possible high efficiencies and long, trouble-free service life.

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returns the valve to neutral. When the selector valve is in the "up" or "down" position, pump flow to the wing flap system is stopped; when the selector valve is in "neutral", pump fluid flows through the wing flap control valve and back to the reservoir. Operating speed of the landing gear is controlled by restrictors in each actuating cylinder.

The wing flaps are operated by a hydraulic motor driving a gear box and screw jacks. Pre-selected setting of the flaps is possible due to the follow-up system and use of a selector valve using a servo plunger as well as a flow control spool. Speed of operation is controlled by orifice check valves. A "phase" valve prevents "splitting" of the wing flaps in case of a torque tube failure. The "phase" valve, a bypass arrangement which allows pump flow to bypass the wing flap system, is tripped to the "open" position by cable control if the flaps "split" more than 5 ½ degrees.

Study Mechanical Linkages

Many of the hydraulic sub-systems incorporate mechanical linkages in the form of gear boxes, torque tube drives, follow-up mechanisms and actuating linkages. These mechanical devices have been duplicated on the mock-up so that the hydraulic components will operate properly and perform the work required of them. A great deal of time was spent, during the construction of the mock-up, in the detailed design of these linkages and rework of the actuating cylinders so that the proper movements and travel were attained.

Both the closed center and the open center systems have a pressure gauge so that pressure in different parts of the airplane hydraulic system can be noted under various operating conditions. These gauges, mounted in the "cockpit", are valuable in trouble shooting. In addition to the pressure gauges, the mock-up is provided with a landing gear and wing flap indicator and two warning lights which indicate when the passenger loading ramp is unlocked and when the electric emergency pump is in operation.

Near the completion of the course, malfunctions or "bugs" are put into the system by the instructor. Students are assigned to specific troubles and are required to remedy them, using trouble shooting procedures learned in class. This directly practical application of their study, is, of course, extremely valuable. It is estimated that without the aid of the mock-up, an additional ten hours of class time would be required; it is doubtful that the extra time would compensate for the practical experience gained by the use of this training device.

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BOEING

THIS PANELIZED HYDRAULIC SYSTEM

features accessibility for maintenance

By J. I. DETWEILER

LOCKHEED'S CONSTITUTION USES A BUS BAR type hydraulic system. This system provides a pressure and a return line to the four extremities of the airplane where hydraulic power is required. Power takeoffs are tapped off these mains wherever required and the control valves are all remotely operated. This plan reduces the amount of plumbing in the airplane to a bare minimum and, due to the size of the airplane, reduces the overall weight of the hydraulic system as compared with a central control valve system. This means that each landing gear is controlled by its own four-way valve, but the valves themselves are simultaneously controlled by one electric switch on the control pedestal in the flight station. A schematic view of the main landing gear system is shown in Figure 1.

The installation of the system features accessibility and ease of maintenance. Because of the size of the airplane, it was possible to group valves together on easily removed panels near the units they control and still have accessibility during flight. The units peculiar only to power system operation and control are grouped together on the rear face of the front shear beam within the box beam, this location becoming the main hydraulic station. Here are located the reservoirs, pressure transmitters, relief valves, pump by-pass valves, super charging pumps, etc. Also within this area on the front face of the rear shear beam are the flap hydraulic units. The main landing gear control valves, emergency extension valves, hand pump and emergency reservoir are grouped together as shown in Figure 2.

The main landing gear valve panels are located on the inboard side of the inboard fuel tank bulkheads in the wing adjacent to the landing gear. The hydraulic connections to the panel are made with fixed length self sealing quick disconnects. These disconnects require no hoses to provide disengagement motion since the overall length when connected is the same as when disconnected. All of the electrical connections to a panel are made through one multiple contact Cannon plug. The panels are mounted to airplane structure with simple hooks and Dzuz fasteners.

Figure 3 shows the landing gear brake and steering control panel on which are mounted the steering directional control valve, brake pressure reducer valve, accumulators, accumulator pressure transmitters, check valves and quick disconnects. This panel is located on the left side of the front face of the forward pressure bulkhead.

Results in Reduced Ground Time

Other small panels are located in the wing and empennage. All valves, with the exception of the brake hand pump selector valve, are remotely operated by either manual cable controls or electric motors. All valves operated by electric motors are provided with a manual handle at the valve for emergency operation in the event of electrical failure.

An analysis of various systems considered for this airplane indicated that panelizing the system would reduce to a minimum ground time resulting from hydraulic failures, inasmuch as the malfunctioning panel can be replaced without appreciable delay of a flight.

Since every part of the hydraulic system is accessible in flight and a means is provided for dumping all system pressure through pump by-pass valves, replacement of a panel may be accomplished in flight, thus making it possible to resume normal flight.

J. I. Detweiler is mechanical research group engineer, hydraulics, Lockheed Aircraft Corporation, Burbank, California.

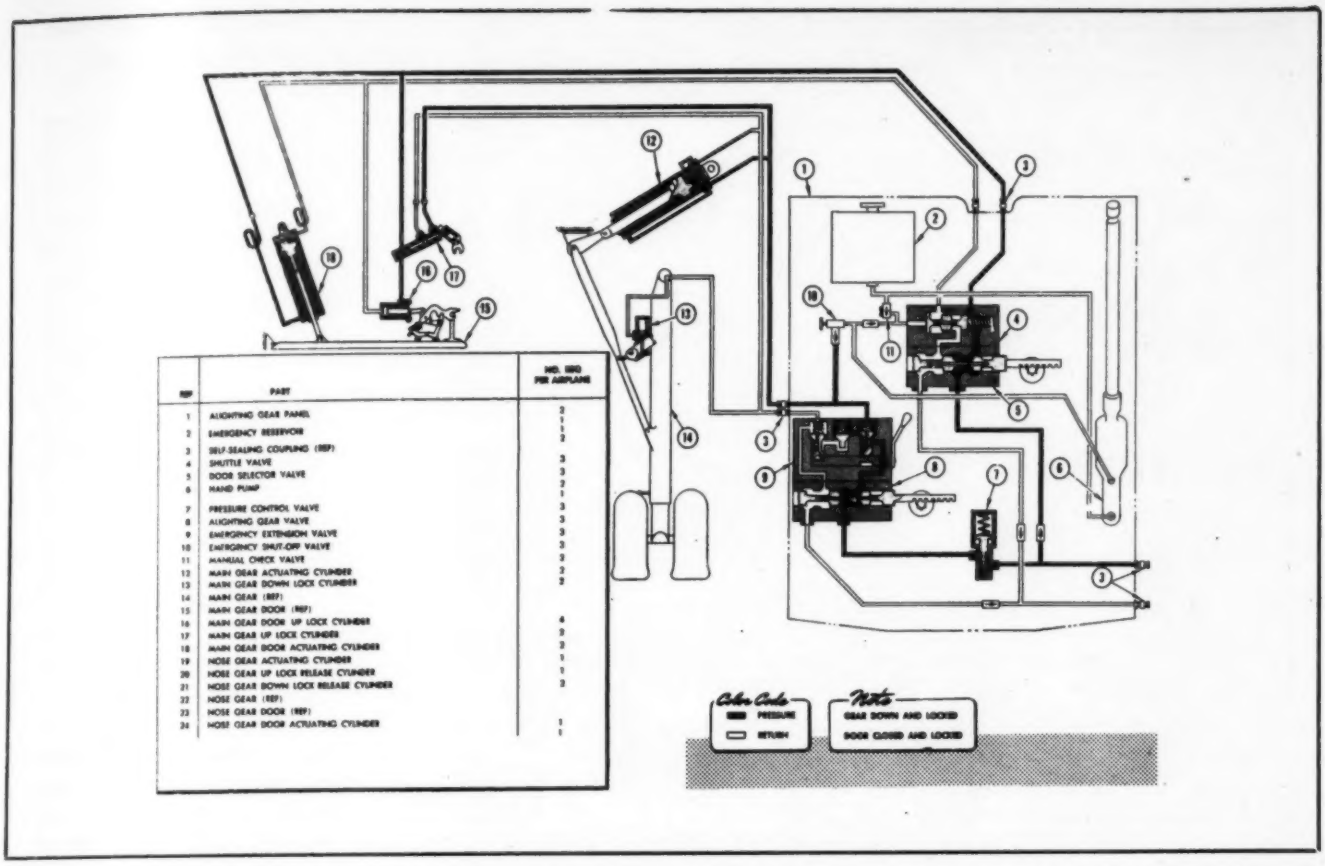


Fig. 1. Schematic of the main landing gear hydraulic system on the XR-60 showing the gear down and locked and the door closed and locked. Mounting components on accessible panel makes it possible to replace panels in flight when necessary. This panel controls the main gear door and the main gear. Two panels, one in each wheel well are used.

The term "panelized hydraulic system" refers to a system in which numerous valves and accessories are grouped together and mounted on a panel which is readily removed or replaced in the airplane as a unit without appreciable loss of fluid or air entrapment. The illustrations used are from Lockheed's Constitution airplane which was built for the Navy and designated as the XR 60.

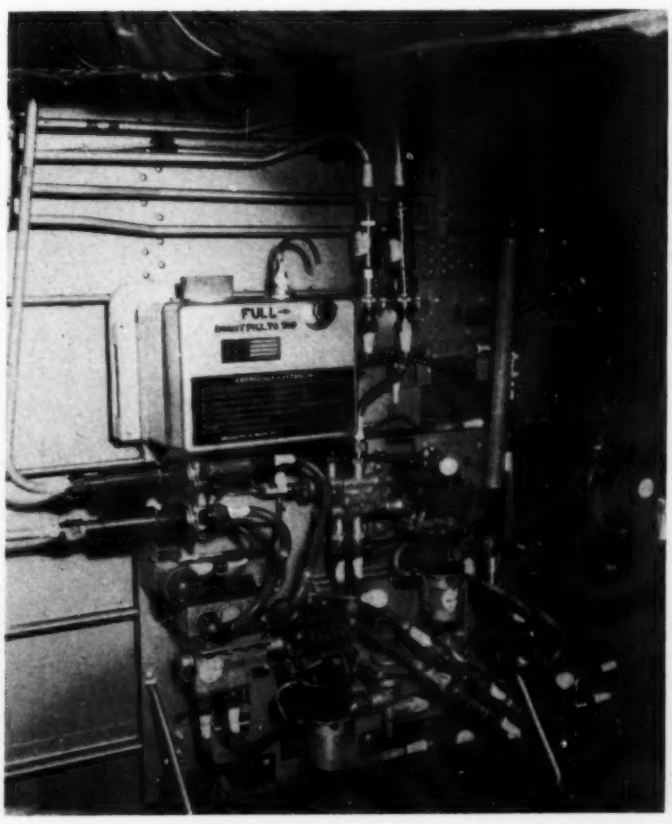
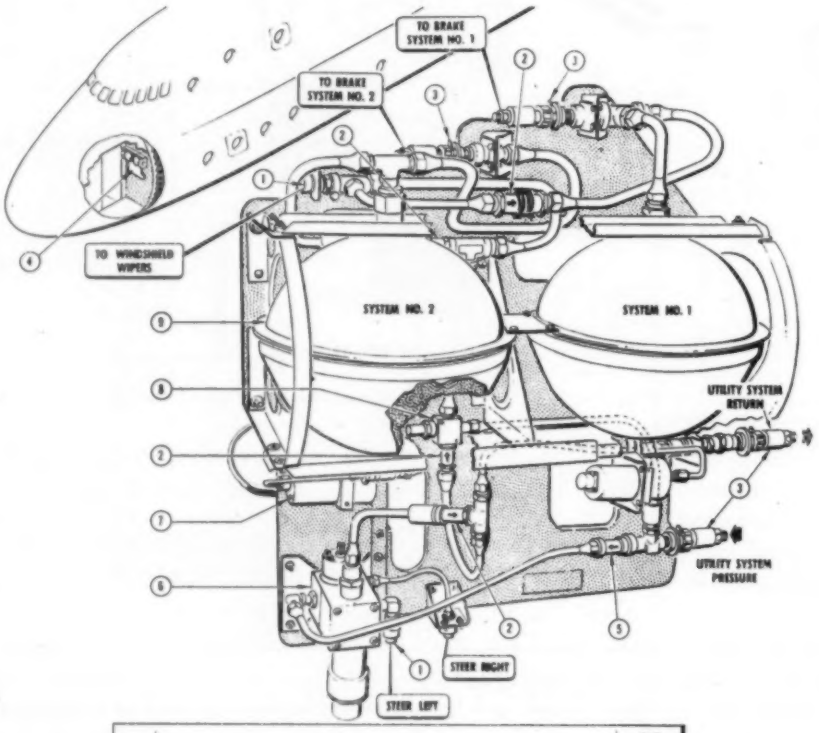


Fig. 2. The main landing gear panel is installed in the wheel well. For emergency operation the gear and door valves may be operated by the hand control valves shown integral with each valve.



REF.	PART	NO. REQ.
1	QUICK DISCONNECT HALF	3
2	CHECK VALVE	3
3	QUICK DISCONNECT HALF	4
4	BRAKE PANEL ASSEMBLY	1
5	CHECK VALVE	1
6	STEERIN DIRECTIONAL CONTROL VALVE	1
7	ACCUMULATOR PRESSURE TRANSMITTER	2
8	PRESSURE REDUCING VALVE	1
9	ACCUMULATOR	2

Fig. 3. Landing gear brake and steering control panel, located on the left side of the front face of the forward pressure bulkhead. Accumulators assure brake holding pressure. An electrically operating directional valve is actuated to control steering. Because of the size of the XR 60, it is possible to group valves together on easily removed panels. The panels are near the units they control and still are accessible during flight.

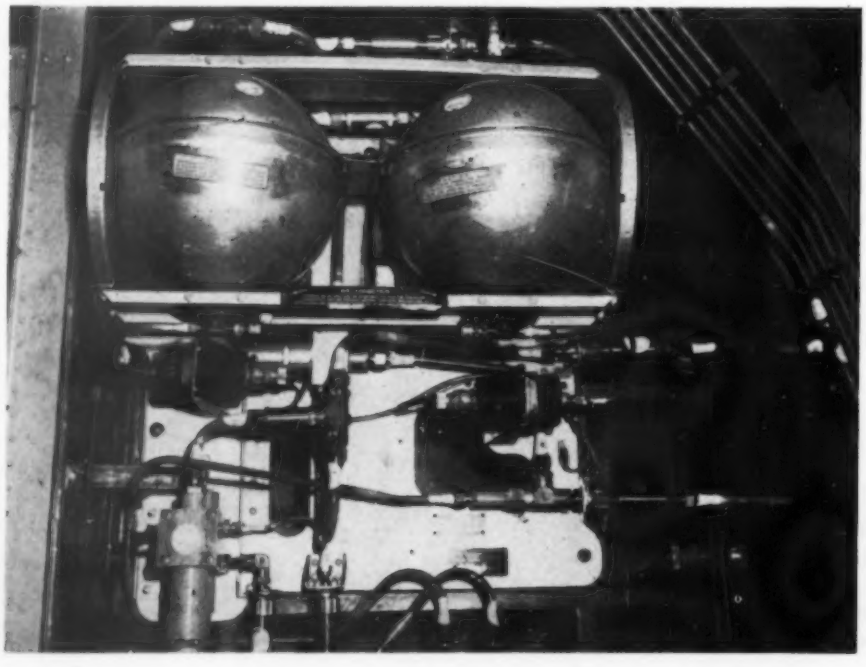


Fig. 4. Picture of the landing gear brake and steering control panel as installed in the nose section. Quick disconnects facilitate removal of a malfunctioning panel without appreciable delay of a flight. The fixed length self sealing quick disconnects do not need hose to provide disengagement motion.

Inventor of Accumulator Honored by Franklin Institute

FOR HIS WORK ON HYDRAULIC and oleopneumatic accumulators used on aircraft and industrial hydraulic equipment, The Franklin Institute has awarded a Certificate of Merit to M. Jean Mercier of Paris, France.

In making the announcement of the award, Dr. Henry B. Allen, executive vice president and secretary of the Institute, stated that it was given "in consideration of new and important combinations of principles already known and for many inventions covering the details of the oleopneumatic accumulators."

Formal presentation of the award will be made on October 17 at special Medal Day ceremonies in the Institute's Franklin Hall, at which thirteen other outstanding scientists will be honored.

"Classification of United States Air Force Equipment and Supplies"

Technical Order No. 00-35A-1, dated 15 August 1951, replaces the T.O. dated 28 November 1950. All of the items, units and assemblies bought and used by USAF are listed in 56 classes. Of major interest are: classes 03, Aircraft and Engine Accessories and Maintenance Parts, which includes actuators, switches, hydraulic and fuel pumps and assemblies, hydraulic and pneumatic cylinders, compressors, filters, hydraulic and vacuum valves; class 05, which includes gauges and gauge units, control assemblies, instruments and meters; class 06, guels and hydraulic fluids; class 17, shop machinery, laboratory and test equipment; class 23, pipe and tubing; class 29, hose, pipe and tube fittings, packings, oil seals and washers.

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Integral 220 Volt 3 phase A.C. Motor
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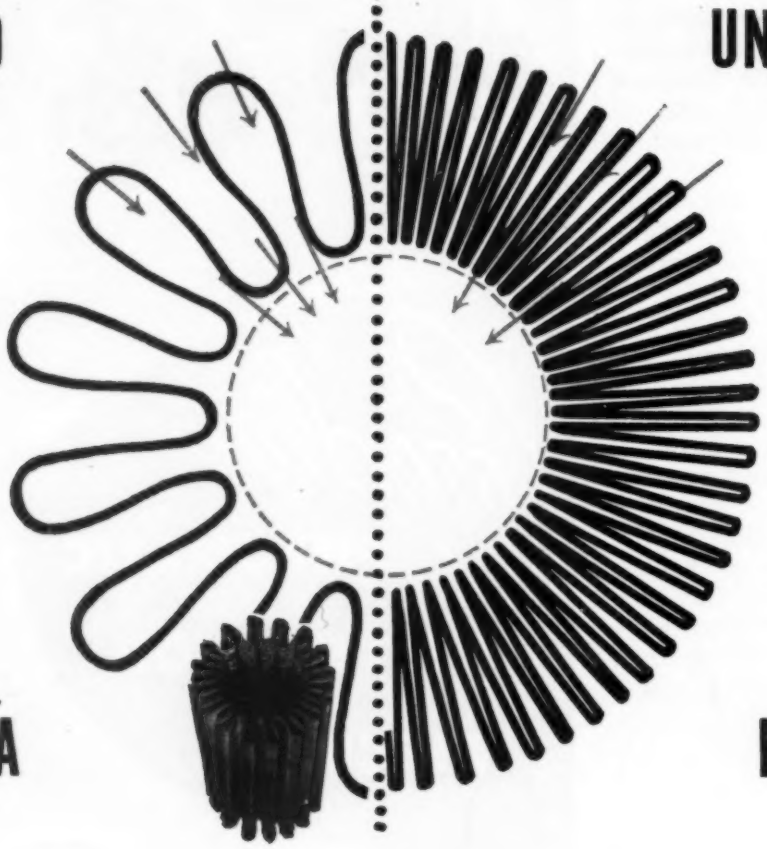
ACTIVE FILTER AREA VS TOTAL FILTER AREA

BALANCED

UNBALANCED

FOR

BY



MAXIMUM ACTIVE FILTER AREA

EXCESSIVE INACTIVE FILTER AREA

LIQUID MUST GET THROUGH TO BE USEFUL!

Elemental, but sometimes forgotten in attempts to pack too much filter mesh into a unit. Liquid entering the outer circumference of the diagrammed corrugated mesh can't be used until it passes out through the inner circumference indicated by the dotted red circle. Marvel engineers have determined scientifically the number of properly proportioned synclinal folds needed to provide the limit of useful ACTIVE mesh area to filter all the liquid that can pass through this outlet space. Crowding more folds of mesh into the same space only increases INACTIVE mesh area; the exit space is the same, can't pass an ounce more a minute. In fact, useless wire mesh obstructing the passae causes even less liquid to pass through. Enough tightly packed folds of excess mesh could cut the flow to a trickle. Balance between mesh openings area and outlet area is imperative for maximum flow rates at minimum pressure loss.

SUMP TYPE
(Cutaway)

LINE TYPE
(Cutaway)

STORAGE CAPACITY FOR FILTERED OUT MATERIAL

Folds of mesh crowded so closely together that they almost touch do not allow enough space between them for accumulated foreign matter. A moderate amount of filtered out material soon fills up all space between folds and reduces operation to filtering at the outer ends only. Well spaced, properly balanced MARVEL SYNCLINAL corrugations leave plenty of space for foreign matter storage without flow interference or pressure build up. Obviously, a filter lacking such space for accumulated material will require more frequent attention.

FOR ALL HYDRAULIC & LOW PRESSURE SYSTEMS wherein non-corrosive liquids are filtered. Available in capacities of 5 to 100 g.p.m. and in mesh sizes from 30 to 200. Multiple installation permits greater capacities. Simplify your preventive maintenance with Marvel Synclinal Filters.

CHOICE OF OVER 240* ORIGINAL EQUIPMENT MANUFACTURERS

*As of August 1, 1951

For complete engineering data on both sump and line type ..lters
Write for Folder 105

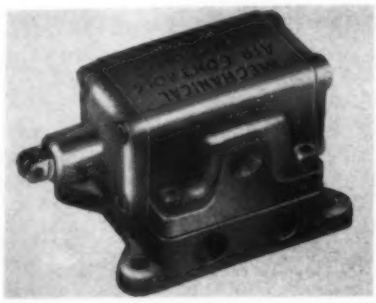
MEETS J.I.C. STANDARDS

MARVEL ENGINEERING COMPANY

625 W. Jackson Blvd. Chicago 6, Ill.

application and performance of NEW COMPONENTS

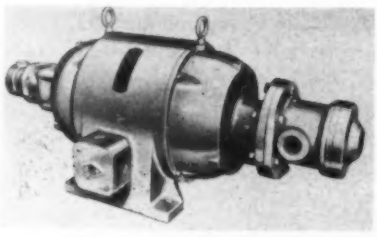
CAM AND PILOT AIR VALVES — Mechanical Air Controls have added cam operated and air pilot pressure operated valves to their line. These two new types are available in the ⅜ in and ¾ in sizes for straightway, 3-way, and 4-way applications up to 150 psi air pressure. Featured is the interchangeability of the end cap construction for the selection of type of control. Removal of four cap screws from a basic valve assembly allows choice of operation by cam, pilot pressure, foot, solenoid, or hand. The basic body assembly remains the same, as all control mechanisms are an integral part of the cap construction. Fast reversal of the valve is obtained by the direct control action on the aluminum spool which is the only moving body assembly part. All types are built to meet J.I.C. specs having cast sub-bases, so that piping need not be disturbed for valve maintenance.



Mechanical Air Controls Inc.

Circle 101 on Reader Service Card

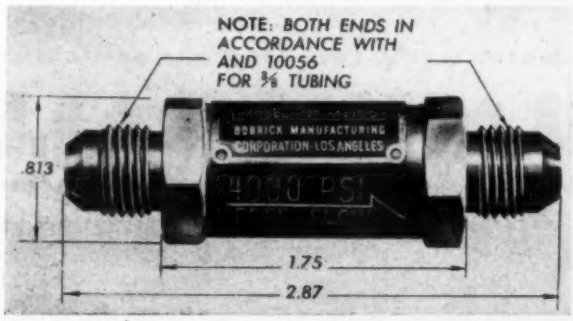
ELECTRIC MOTOR FOR HYDRAULIC PUMPS — The Reuland Electric Company has announced a new hydraulic pump motor which features an exclusive new system of direct mounting between pump and motor. This new system has been standardized and is adaptable to all makes of pumps. Primary among the benefits derived from this new development is automatic precision alignment in every installation. All motors are supplied with machined end bell flanges, preengineered to fit the registers on the pump mounting flange. This elimination of the alignment problems, encountered in the conventional coupling hook-up of two separately mounted units, reduces both original cost as well as maintenance. This is particularly so in high pressure pumps where tolerances between the pump element and housing are normally held very closely, and even the slightest misalignment causes excessive wear. Installation costs are reduced and overall dimensions are reduced, assuring compactness and improved appearance.



The Reuland Electric Company

Circle 102 on Reader Service Card

4000 PSI PNEUMATIC CHECK VALVE — The Bobrick pneumatic check valve designed for efficient dependable operation at air pressures up to 4000 psi and hydraulic pressures up to 5000 psi.

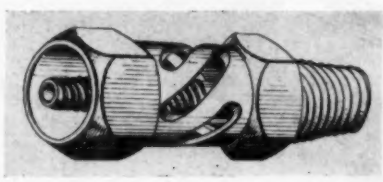


Maximum free flow is 7 pounds per minute. Maximum pressure drop through the valve is 100 psig at 7 pounds per minute air flow with an air inlet pressure of 150 psig maximum. Leakage in reverse flow direction will not exceed 200 cubic inches of free air per minute at 4000 psi. The proof pressure of this check valve is 5200 psi. The 3.4 ounce valve is manufactured of stainless steel. Using a standard AN 6249-6 envelope, both ends of the unit are in accordance with AND 10056 for ⅜ inch tubing.

Bobrick Manufacturing Corporation

Circle 103 on Reader Service Card

HOSE COUPLING . . . Twist-Grip couplers made to specification for hoses up to 1 ½ in o.d. are self-swaging couplings. A weakened intermediate slotted portion between strong hexagonal ends, collapses onto the hose when one hexagonal end is twisted with a wrench while the other end is held fast. These collapsed walls become metal fingers that firmly grasp the hose with an immovable clutching power that prevents the hose from pulling away under pressure. This new line of time-saving coupler clamps can be made from any desired type of metal and are made to fit the hose you use.



Producers Sales Company

Circle 104 on Reader Service Card

MELETRON

PRESSURE ACTUATED SWITCHES *for* EXPLOSIVE ATMOSPHERES

Accurate response to *any* pressure or vacuum change may be achieved with safety in atmospheres containing vapors of ethyl, ether, gasoline, alcohol, acetone, petroleum, naphtha, lacquer solvents as well as natural gas or grain dust.

Meletron explosion-proof models incorporate U.L. approved Micro-Switches. Pressure elements are adjustable in the field without exposing the circuit.

Meletron is your electric-hydraulic link.

SOLE DISTRIBUTOR FOR INDUSTRIAL APPLICATIONS

BARKSDALE

1566 EAST SLAUSON AVENUE, LOS ANGELES 11, CALIFORNIA

FLEXIBLE COUPLING — Amerigear flexible couplings are made in sizes to handle drive applications from light to heavy duty. This coupling consists of two identical gear hubs within a floating sleeve. This sleeve is ordinarily made in two halves and bolted together to facilitate installation and alignment. External gear teeth, of special design, are cut integrally on each hub and fully engage internal gears at the opposite ends of the floating sleeve. A unique modification of the external teeth of the hub allows for misalignment between the gear teeth of the hubs and the gear teeth of the sleeve.

American Flexible Coupling Company

Circle 105 on Reader Service Card

VIBRATION ISOLATOR — New units, added to the line of All-Metl unit vibration isolators developed and manufactured by The Barry Corporation, cover new load ranges to 8 to 16, 14 to 25, and 22 to 35 pounds. The new units are available in the 6600 series, the 6645, 6600R and 6645R series. All these new unit vibration isolators exhibit excellent performance and are unaffected by very extreme temperatures.

The Barry Corporation

Circle 106 on Reader Service Card

Do you know—there are over one thousand rubber companies in the United States, but only one original Plastic and Rubber Products Co. that specializes in the manufacture of "O" rings for *all* applications?

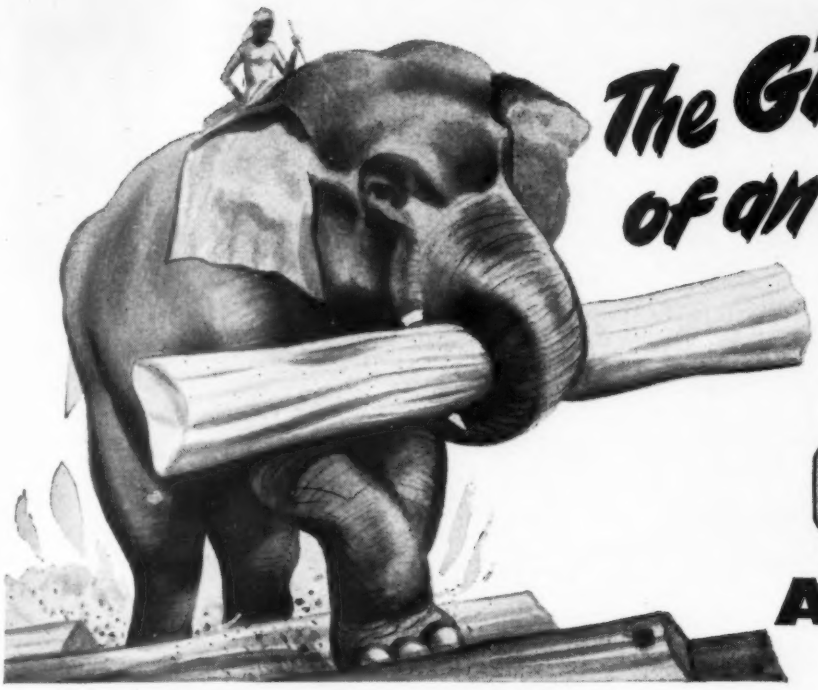
Consistent quality through years of service to industry has earned Plastic and Rubber Products Co. the highest reputation in the packing field. Parco gives you quality and service as extras, available to you at no premium. Consult Parco. All dash numbers of 6227, 6230 and 6290 series for commercial applications and military "O" ring packings and gaskets to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special materials and compounds are available on order.

Catalog and engineering data on request. Write us today.

Plastic and Rubber Products Co.

2100 Hyde Park Boulevard, Los Angeles 47, California
820 North State Street, Chicago, Illinois

Circle 40 on Reader Service Card



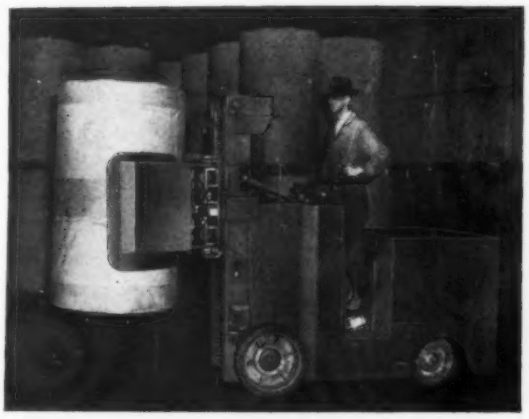
The GRIP of an ELEPHANT

with a

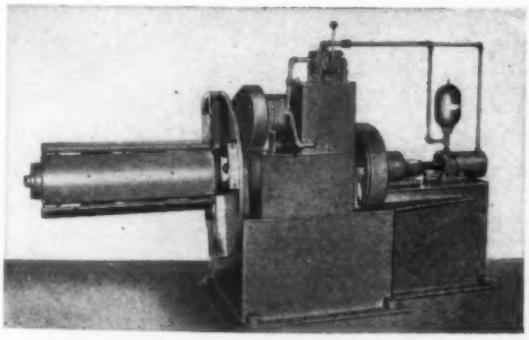
10 CUBIC INCH

GREER

ACCUMULATOR



This lift truck holds heavy paper rolls between its jaws with the grip of an elephant, thanks to a 10 cubic inch Greer Accumulator. There is no chance of the roll slipping because the accumulator automatically compensates for any hydraulic fluid leakage or pressure loss.



Steel coils on this pay-off roll are held firmly in place during uncoiling by hydraulic pressure stored in a one gallon Greer Accumulator. A pressure switch eliminates the necessity for continuous pumping during the extended holding operation, saving power and pump wear.

Greer Hydro-pneumatic Accumulators are revolutionizing the design of materials handling and production equipment. Cumbersome, complicated, expensive devices for holding and chucking are being replaced with simple, efficient hydraulic units and Greer Accumulators.

A Greer Accumulator consists of a gas filled synthetic bag inside a steel chamber which stores hydraulic fluid pumped into it against pressure in the bag. This energy can be released as needed for restoring pressure loss due to fluid leakage in the system, as an auxiliary source of power for peak loads, and for many other functions described in our new Bulletin 301.

Greer Bulletin 301 is packed with ideas showing how to reduce the size, complexity, and operating cost of equipment with Greer Accumulators by utilizing energy ordinarily wasted during prolonged holding cycles or during intermittent machine operations. Send for your copy today.

GREER
ACCUMULATORS

U. S. PATENTS UNDER OLEAR LICENSES

GREER HYDRAULICS, INC.

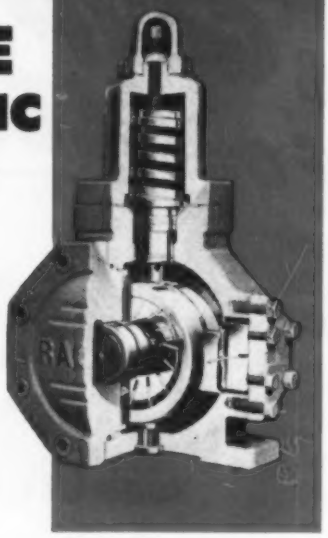
456 EIGHTEENTH STREET • BROOKLYN 15, NEW YORK

Sales Representatives in Principal Cities • District Office: 407 So. Dearborn St., Chicago 5

Manufacturers of Hydraulic Accumulators • High Pressure Hydraulic Components

RACINE HYDRAULIC PUMPS

Simplify your Circuit



Less valves and controls in a circuit provide easier installation and lower initial costs.

RACINE "Variable Volume" Pumps eliminate relief valves and extra piping. They reduce horsepower requirements and avoid excessive heat losses. Over-all cost of motor and reservoir is usually reduced. Efficiency is high because RACINE Pumps "put all of the oil to work."

A wide range of governor controls provide pumping action at the proper pressure and volume to handle any given job most effectively. These interchangeable governors are an exclusive RACINE feature.

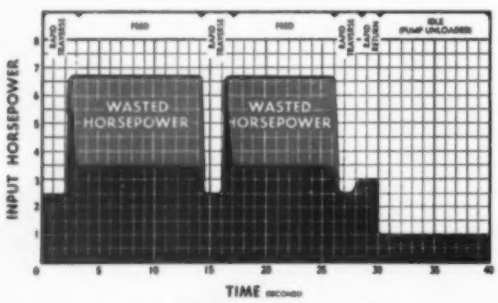


Chart above illustrates power consumption on a typical machine tool. Black area is power used with a No. 2 RACINE "Variable Volume" pump controlled by a pressure compensated feed valve. Area in color is power wasted by a constant volume pump, bypassing most of its volume through a relief valve during the feeding cycle.

OTHER RACINE HYDRAULIC PRODUCTS

Four-Way Valves

Pressure Boosters

Pump & Reservoir Units

Write for new 3-color Catalog P-10-D covering RACINE's complete line of "Variable Volume" Pumps, Valves and Pressure Boosters.

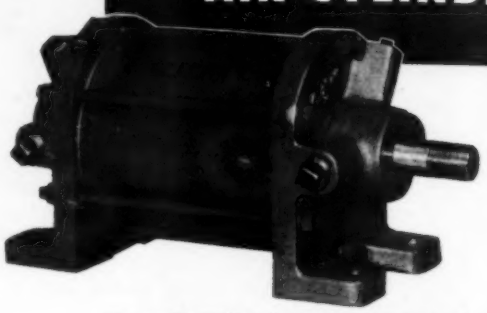
RACINE

TOOL AND MACHINE CO.

1775 State Street, RACINE, WISCONSIN, U. S. A.

Circle 37 on Reader Service Card

PATHON AIR CYLINDERS



are outstanding in performance and versatility

• Pathon double-acting air cylinders are designed to simplify and eliminate complicated mechanical linkages. These versatile compact power units are available in standard or special designs. Make your selection from the six standard models which are built in 1½ through 12 inch bore diameters, in any stroke to 144 inches. Deliveries are prompt on many mounting styles and sizes.

Pathon also manufacturers a complete line of water and oil hydraulic cylinders.

For complete details on air cylinders, write for Bulletin 12A.

PATHON MANUFACTURING CO.

1733 Central Avenue • Cincinnati 14, Ohio

SKINNER STAINLESS STEEL SOLENOID VALVES

Small size — Rugged — Large capacity

The small size of Skinner Solenoid Valves belies their rugged construction and unusually large capacity. These valves have a standard range from 5 to 250 p.s.i., and a special range from 5 to 850 p.s.i., and can be used for gaseous or liquid media. Their soft insert seat prevents leakage and positive action is assured by spring loading. Skinner Valves may be used in any position, with pipe connections furnished to suit specifications. Power consumption is 10 watts max. Special coils for high humidity or high temperature applications can be supplied. Standard models are approved by Underwriters' Laboratories.

Write for Bulletin No. 501

SKINNER ELECTRIC VALVE DIV.

THE SKINNER CHUCK COMPANY

142 Belden Ave., Norwalk, Conn.

Circle 42 on Reader Service Card

Useful Catalogs and Bulletins

available for reference

Air Valves . . . Compact, sturdy construction, air valves for heavy duty and high cycle operation are described in a bulletin offered by Automatic Valve Company. Cross-sectional drawings and dimensional details are given for 3- and 4-way solenoid operated valves, and pilot and speed control valves. Colored schematic drawings clearly show the principle of operation of these valves. The 3- and 4-way valves, offered in pipe sizes from ¼ to ¾ in, are pilot operated having a short solenoid stroke which gives exceptionally high operating speeds with full volume. They are designed for automatic cycling up to 600 times per minute and for pressures of 20 to 150 psi.

Circle 121 on Reader Service Card

Hydraulic Cylinders . . . Does your cylinder application call for a perfectly round housing which is free from interfering bosses and tie rods? The Commercial Shearing & Stamping Company's 53 page Catalog H-3 presents their complete standard line of double acting, single acting, telescopic oil hydraulic cylinders of the heavy duty type, suitable for operating pressures up to 1500 psi. These cylinders are designed to take up a minimum amount of space. The Catalog includes complete details covering many different types of mountings, style of fittings, ratings, dimensions and mounting data are fully covered. A few typical field applications takes from hundreds of installations of "Commercial" cylinders in use are shown.

Circle 122 on Reader Service Card

Motor Starters . . . A new eight page folder illustrating and describing a new line of Arrow-Hart "Explo-Safe" and Weatherproof motor starters for hazardous locations has been issued by the company's Industrial Control Division. The folder gives complete information including dimensions, weights, ratings and wiring diagrams for these magnetic across-the-line starters which are claimed to be smaller and lighter than conventional motor starters. The reduction in size and weight is made possible by use of Arrow-Hart's patented right angle "RA" mechanism. These motor starters in NEMA types VII, IX and IV are approved by Underwriters' Laboratories.

Circle 123 on Reader Service Card

Hints on Motor Maintenance . . . Benjamin Hantman, Works Engineer, Motor and Control Division of Westinghouse Electric Corporation has prepared a seven page illustrated leaflet on motor maintenance. He points out four well-known symptoms of motor trouble, tells the causes and, with pictures, suggests maintenance procedure. The four symptoms are: 1. Motor does not turn over, and is quiet. 2. Motor does not turn over, but growls or is noisy. 3. Motor does turn over, but will not get up to speed. 4. Motor gets up to speed, but runs too hot. Use of pictures clearly shows the suggested maintenance procedures with a minimum of text making this leaflet a handy quick reference.

Circle 124 on Reader Service Card

Packaged Oil Unit . . . The Hydracter, built by Benjamin Lassman & Son, is described in a new 8-page bulletin. This unit is a completely self-contained, heavy-duty hydraulic linear actuator, having oil reservoir, electric motor, pump, operating valves and cylinder. The unit does away with all external components and piping, making installation simple. Standard models provide working forces to 4000 pounds. The Series P Hydractor which is a power package without the cylinder is also described. Specifications for models to 6 horsepower are charted.

Circle 125 on Reader Service Card

Reciprocating Pump . . . The Aldrich Pump Company offers Data Sheet 67-A, describing the Aldrich 6 in stroke Direct Flow Pump Series—recently added to the over-all Aldrich line. A two-color, 8-page bulletin, Data Sheet 67-A gives full details of design and construction including dimension and sectional drawings, performance data and pump specifications. Applications for 6 in stroke pumps include hydraulic systems as well as chemical handling, descaling systems and oil field service.

Circle 126 on Reader Service Card

"Bouncing Pipes" . . . Do you understand the cause of surges in air lines? It's a tough problem which even has the physicists puzzled when it comes to explaining exactly why pipes bounce. Burgess-Manning Company's R. L. Leadbetter has written an informative booklet which he titles "Bouncing Pipes". Designated as engineering Bulletin 121, this 15 page booklet, describes in very non-technical terms just how shocks and surges develop in air systems. Using sketches the concepts of mass, electricity, compressibility, inertia and wave formation are very clearly presented.

Circle 127 on Reader Service Card

Stainless Steel Handbook . . . A new data and handbook on the stainless steels has been published by Allegheny Ludlum Steel Corporation and is now available, free, to users of heat and corrosion resistant metals. In its 120 pages the cloth-bound volume discusses approximately 40 different types of Allegheny Metal stainless steel and covers each type from standpoints of analyses, fabrication, heat treatment and special conditions of service. Chapters deal with the selection of the proper type of stainless for a given applications, and discuss each type of stainless separately. Selector tables and charts listing characteristics are used throughout the book.

Circle 128 on Reader Service Card

Circle 44 on Reader Service Card

the right answer

. . . to every gauge need IN THIS NEW CATALOG

The right answer—the Marsh answer — to every pressure gauge need is described by this new Marsh catalog which covers hundreds of variations of styles, types, mountings, ranges, functions. Remember that Marsh gauges, from the "Standard" series line to the heavy-duty "Mastergauge" series have proved across the years to be the most economical you can buy for a given set of conditions. Let us prove this in terms of gauges for your product.

MARSH INSTRUMENT CO.

Sales affiliate of Jas. P. Marsh Corp., Dept. 19, Skokie, Ill.
Export Dept.: 155 E. 44th St., New York 17, N. Y.

Circle 45 on Reader Service Card

"SEAL-GUARD" METALLIC ROD WIPER

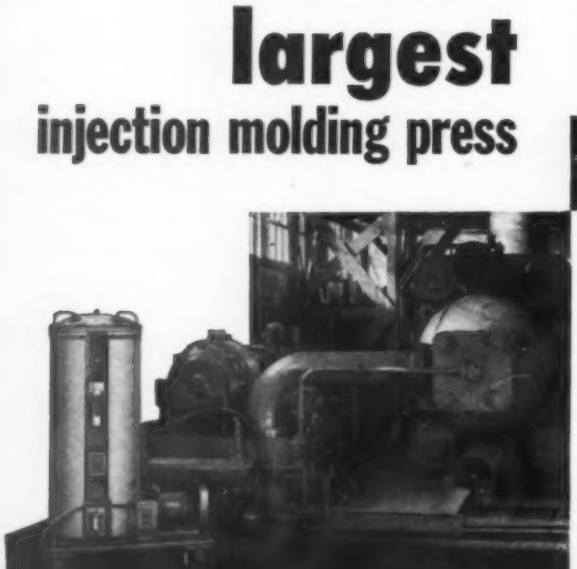
PROTECTS YOUR CYLINDER RODS, MACHINE SPINDLES, GUIDE PINS AND LOCATING PINS

The "Seal-Guard" Metallic Rod Wiper affords permanent protection from falling or flying debris . . . Two flexible bronze rings mounted in synthetic rubber lift off harmful substances completely by means of their knife-edged conical surfaces . . . The device is self-adjusting through action of rubber on staggered scraper rings . . . Rod diameter sizes are from ½ to 10 inches.

Write for Literature

HYDRAULIC ACCESSORIES CO.
439 E. Fort St. • Detroit 26, Mich.

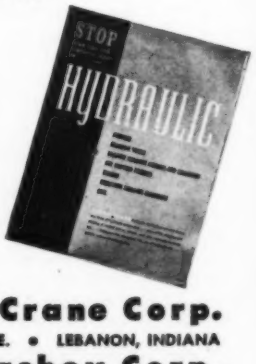
world's largest injection molding press



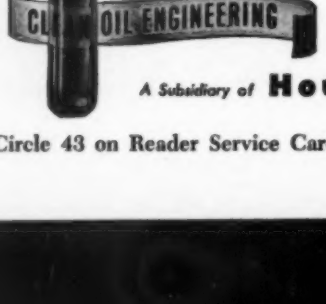
gets Honan-Crane Hydraulic Oil Purification

. . . world's most dependable protection against damage, downtime, lost production due to contaminated, oxidized oil!

FREE! New 8-page "Hydraulic Bulletin" and Hydraulic Oil Case Histories describe in detail the profitable advantages of Honan-Crane Oil Purification in Plastic molding operations and many other critical hydraulic applications. Write to us for your free copies TODAY!



● This 69-ton, 300-ounce Watson-Stillman press accommodates dies up to 72" x 48". One of 14 injection molding machines at Amos Molded Plastics, Edinburg, Indiana, it employs a 7½-ton, 550 gallon hydraulic oil pumping unit (shown above being serviced by Honan-Crane Oil Purifier). Hydraulic equipment at Amos Plastics has been protected by Honan-Crane Purifiers since 1942.



Honan-Crane Corp.
102 WABASH AVE. • LEBANON, INDIANA
A Subsidiary of **Houdaille-Hershey Corp.**

Circle 43 on Reader Service Card

Constant Delivery Piston Pumps . . . New four page Bulletin 46601 illustrates and describes three new Oilgear constant delivery axial piston pumps for pressures up to 300 and 500 psi. These units incorporate such tried and proven patented designs as balanced flat valves (port plates), simple one-piece rolling pistons and reverse flow high pressure and supercharging pressure relief valves. The 100 percent supercharge permits smaller intake passages, reduces area of flat valve, minimizes compression of oil, eliminates entrance of air and assures quieter operation. These units are especially suitable for heavy-duty pushing, pulling, lifting and lowering and for maintaining high static clamping loads.

Circle 136 on Reader Service Card

Aviation Products . . . Here is product data describing Johns-Manville gaskets, seals and packings designed for applications in aircraft. Charts are used throughout this 12 page bulletin to conveniently list materials, applications, construction and weights and sizes. Included in this bulletin are Johns-Manville molded packings for use as retention seals and shaft packings on hydraulically or electrically operated equipment, including reversible pitch propellers, landing gear struts, hydraulic systems and aircraft engines and accessories. In their design, consideration is given to shore durometer, tensile strength, elongation, volume of oil and gasoline swell, air and oil aging, compression set and low-temperature brittleness.

Circle 137 on Reader Service Card

Air Purifiers . . . Issued by The Centrifix Corporation, their four-page general bulletin illustrates and describes functions of nine types of purifiers for entrainment separation in air gas applications. Special purpose purifiers described include an air intake purifier for use on compressors. Centrifugal and centripetal forces are used to obtain 99.9 percent separating efficiency without moving parts or mechanical filters.

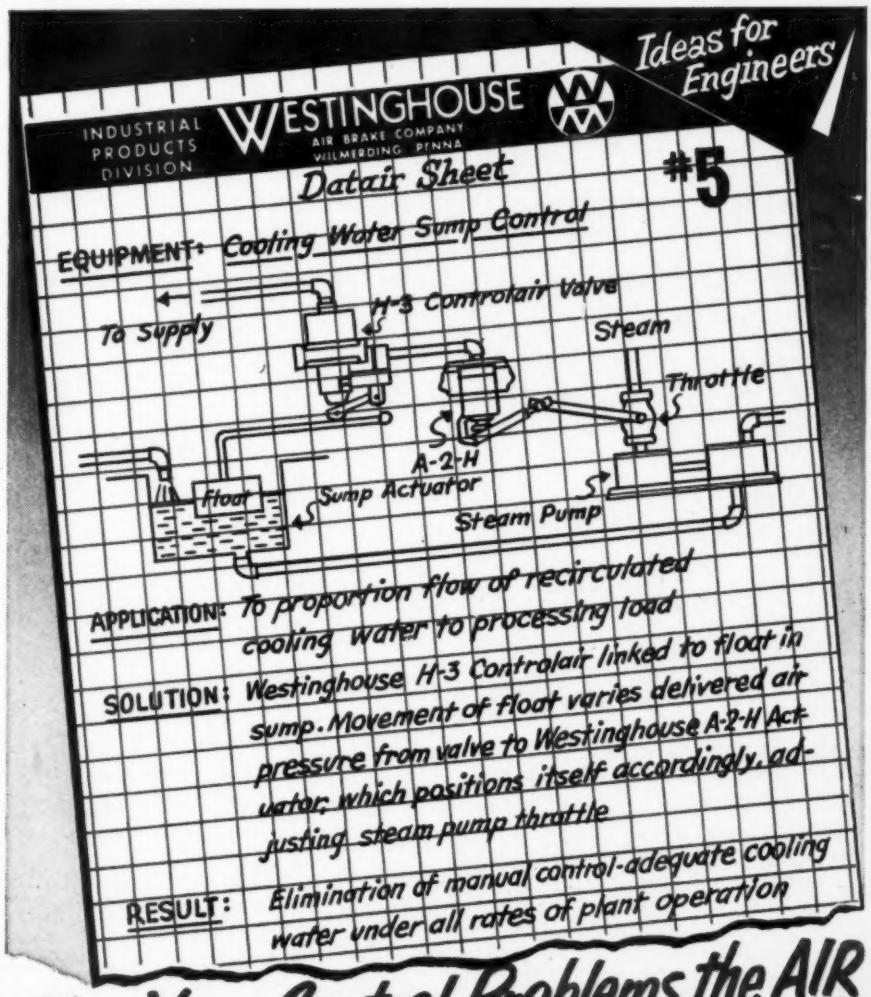
Circle 138 on Reader Service Card

Steel Tubing Data . . . Assistance in solving problems involving the use of alternate grades of medium carbon, or full hardening grades of tubing steels, is offered in a new four-page bulletin published by The Babcock & Wilcox Tube Company. Known as Bulletin TDC 141, it presents condensed data on microstructure, critical points, effect of alloy elements, forging, machining, welding and thermal treatment for 14 well-known alloy steels used in the production of tubular parts.

Circle 139 on Reader Service Card

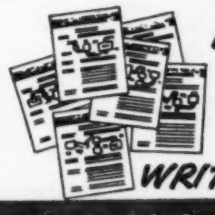
Air Cylinders . . . Twenty-eight different models of air cylinders, each in nine bore diameters, are illustrated and described in the new Catalog Section No. 55, published by Rivett Lathe & Grinder, Inc. The three-color book lists every standard air cylinder offered in the industry. Working drawings and specifications are furnished for each model and size cylinder, both standard and cushioned types, single and double end rods, internal and external threads. Information relative to a particular model is all shown on one page, facilitating easier layout of circuits by the engineer. Recommended for air pressures of 150 psi max and oil pressure of 300 psi max, Rivett cylinders are designed without tie rods, and have keeper ring construction which permits covers to be rotated to convenient pipe locations.

Circle 140 on Reader Service Card


Ideas for Engineers
INDUSTRIAL PRODUCTS DIVISION
WESTINGHOUSE
AIR BRAKE COMPANY
WILMERDING PENNA
Datair Sheet
#5
EQUIPMENT: Cooling Water Sump Control
To Supply
H-3 Controlair Valve
Steam
Throttle
A-2-H
Sump Actuator
Steam Pump
Float
APPLICATION: To proportion flow of recirculated cooling water to processing load
SOLUTION: Westinghouse H-3 Controlair linked to float in sump. Movement of float varies delivered air pressure from valve to Westinghouse A-2-H Actuator, which positions itself accordingly, adjusting steam pump throttle
RESULT: Elimination of manual control-adequate cooling water under all rates of plant operation

Give Your Control Problems the AIR

Here's an example of how one smart Plant Engineer used W A B Pneumatic devices to inexpensively lick a continuous control problem. Our Enginairing Data File shows many others. Your ingenuity will suggest ways you can adapt the ideas to solve some of YOUR problems. Write for a complete file for permanent reference. No charge.



FREE
This Enginairing data file
WRITE

INDUSTRIAL PRODUCTS DIVISION
WESTINGHOUSE
AIR BRAKE COMPANY
WILMERDING, PENNA.

Distributors throughout the United States . . . Consult your Classified Directory. Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario

Circle 46 on Reader Service Card

Revised J.I.C. Hydraulic Standards . . . Revised to incorporate all changes and additions made at the most recent meeting of the Joint Industry Conference on Hydraulics, this newest edition of the standards is offered free to engineers, designers, hydraulic equipment users and manufacturers by Miller Motor Company. The revised standards are reproduced word-for-word in a neat, attractive 8 ½ x 11 16 page booklet.

Circle 129 on Reader Service Card

Force Indicator . . . A four page bulletin just published by the Hunter Spring Company includes specifications on their twelve models of the force indicator, a precision instrument widely used for accurate force measurement (up to 20 pounds) in design, research, production, inspection and maintenance. Operation of the indicator, types of loads measured and typical applications, are covered in the two color illustrated bulletin.

Circle 130 on Reader Service Card

Piston Rings . . . Thirteen different types of metallic piston rings are described in a new catalog edition now being distributed by the Double Seal Ring Company. The 16 page booklet, using two colors throughout, contains complete explanations of the uses of rings listed, large illustrations, and complete instructions for ordering.

Circle 131 on Reader Service Card

Drain Valves For Compressed Air Lines . . . Wilkerson Corporation offers a 12 page catalog describing their new automatic drain valves for compressed air systems. Automatic separators and drains for interrupted and continuous flow conditions are detailed. Descriptions of automatic sump and aftercooler drain and air governor and governor filters are included. Charts and drawings clearly show the simple effective operation of the diaphragm type valve filter.

Circle 132 on Reader Service Card

LIMA GEARSHIFT DRIVES

Offer

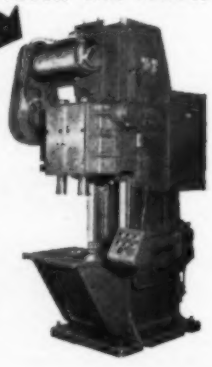
☆ INCREASED PRODUCTION

☆ GREATER MACHINE FLEXIBILITY

☆ LOWER OPERATING COSTS

If production costs are out of balance with selling prices, and cutting into profits, it will pay you to investigate the advantages of LIMA GEARSHIFT DRIVES. Lima Drives will increase production, give greater machine flexibility, and, at lower costs. The end result will reflect in Greater Profits.

LIMA maintains a national Sales Engineering staff to assist you in solving your selective-speed drive problems. Let LIMA recommend the drives you need.



Lima Gearshift Drives are making increased profits for the users of the Moline No. 113FB Hydraulic Rail Feed Machine, built by the Moline Tool Company, Moline, Illinois, and powered by a 7½ HP, Type R4 Lima Gearshift Drive *as standard equipment.*

LIMA ELECTRIC MOTORS

WRITE FOR BULLETINS

Representation in principal cities

THE LIMA ELECTRIC MOTOR COMPANY

2740 Findlay Road • Lima, Ohio

Circle 47 on Reader Service Card

Squirrel-Cage Induction Motors . . . Construction features of Allis-Chalmers large end-shield bearing squirrel-cage induction motors are described in a new bulletin. Built for a wide range of applications from central station auxiliary to general industrial drives, these motors are available in ratings and speeds up to 1750 hp at 1800 rpm. Construction features of these motors include welded stator yoke, long-life stator winding, capsule-type housings, split sleeve bearings, air-gap access holes, silver-brazed cage, protecting end shields, large discharge openings, and inherently drip-proof design.

Circle 133 on Reader Service Card

Duck and Rubber Packings . . . Various types of duck and rubber packings including low pressure, cross expansion, hydraulic, hollow core, round rubber core, and diagonal expansion types are all described in an 8-page bulletin issued by the Packing Division, Raybestos-Manhattan, Inc. This bulletin gives complete service recommendations for each type packing, lists the standard sizes in which each is available and gives complete packaging specifications on all types.

Circle 134 on Reader Service Card

Heat Exchangers . . . Taco Heaters, Incorporated has prepared an attractive bulletin describing their organization, products and services. Their line of oil coolers and thermostatic devices are illustrated. Used in many industries, this equipment finds application on any hydraulic power system which requires temperature regulation.

Circle 135 on Reader Service Card

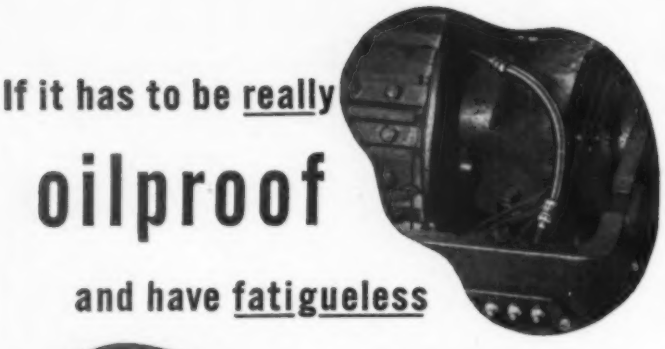
PIONEER MANUFACTURER
OF QUALITY
"O" RING SEALS
THE NATION'S LARGEST
EXCLUSIVE PRODUCER
PRECISION RUBBER
PRODUCTS CORPORATION
MAIN OFFICE AND PLANT
3110 OAKRIDGE DRIVE • DAYTON 7, OHIO
BRANCHES IN ALL PRINCIPAL CITIES

If it has to be really

oilproof

and have fatigueless

flexibility...



USE

RESISTOFLEX

HOSE ASSEMBLIES

There's nothing to fatigue in Resistoflex hose—not the synthetic rubber jacket, the high grade yarn braiding, nor the compar tube.

And no gumming, eroding or swelling from oil either. For the compar tube is impervious to water-insoluble oils and compounds. The compar tube also adds more than necessary strength for medium pressures and shock loads in hydraulic systems.

For years, many well known companies have standardized on Resistoflex Hose Assemblies to assure minimum line troubles and replacements. You, too, will find that Resistoflex quality pays off in the long run. Write for specification sheets.

For out of the ordinary engineering with synthetics

RESISTOFLEX

RESISTOFLEX

CORPORATION

Belleville 9, New Jersey

Beginner's Course

(Continued from page 45)

ing bearing loads which permit use for loads as high as 15 horsepower. Both internal and external gear motors are limited by a maximum pressure of about 1500 psi. Speed is controlled by rate of supply of hydraulic oil.

Vane Motors

Vane pumps which depend upon centrifugal force only to extend the vanes, will not function as motors unless rotation is started by some power source other than oil pressure—an impractical situation.

The Dudco vane pump (see page 70 May issue, APPLIED HYDRAULICS) which uses pressure oil to hold the vanes extended and has shaft loads hydraulically balanced offers a highly efficient motor source. Horsepower output as high as 125 hp can be attained at speeds of 1200 rpm.

Piston Type Motors

Most hydraulic motors are piston type construction. These motors have low slip and many designs will operate at speeds below 10 rpm. By comparison, minimum speed rating on most gear motors is about 100 rpm. Piston type motors can be both constant or variable displacement; which means the motor speed can be controllable at the unit if it is a variable displacement design. However, while a pump may be varied from zero to maximum displacement, it is not possible, due to mechanical inefficiencies, to vary a motor to give a speed variation of much more than 4 to 1. Piston type motors can move loads as high as 300 hp at oil pressures to 3000 psi and speeds of 1800 rpm.

Fluid Motor Characteristics

Rotary motors are primarily used to develop torque. Oil pressure acting on the pump elements produces a force which, acting at a distance from the center of rotation, produces a turning torque. Torque may be expressed as a function of horsepower and speed.

$$HP = \frac{Tn}{5250}, \text{ where } T = \text{torque in ft-lbs and } n = \text{rpm}$$

In terms of pressure p, in psi, and displacement q, in cu in per rev:

$$T \text{ in ft.-lbs} = \frac{qp}{24\pi}$$

From these basic equations it can be seen

that constant displacement motors are constant torque devices. Horsepower will vary with speed, while torque for a given hydraulic pressure is the same at all speeds. With a variable displacement motor, the torque will vary inversely with speed causing horsepower output to be constant at all speeds for a given operating pressure.

One of the outstanding features of axial piston motors is their low inertia. Such motors have been designed to accelerate from stationary to 3000 rpm in one revolution. Low inertia of course, permits extremely fast reversals.

Power capacity of any hydraulic motor is limited by permissible operating pressure and maximum speed. The pressure is a function of mechanical strength, and speed depends largely on bearing design. Provided sufficient oil volume is available to run a motor at maximum rated speed, regardless of volumetric losses, the power, capacity of a pump depends entirely on its mechanical efficiency.

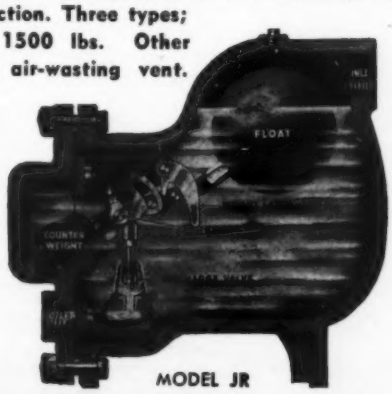
Starting torque is another important characteristc to be considered when choosing hydraulic motors. Generally, starting torque is only slightly higher than running torque. Some motors can stand a peak torque overload of 150 percent normal torque for very short intervals.

New NICHOLSON

NON-PLUG AIR TRAPS

Introduce Oil-Eliminating Feature Preventing Build-Up of Scum and Sludge

In these Nicholson air traps you enjoy the advantages of the positive intermittent action of a float-operated air trap without the common problem of oil congealing on the mechanism and impeding or stopping its action. Three types; pressures to 1500 lbs. Other features: No air-wasting vent. Positive water - seal at valve. Large orifice keeps valve clean. For details send for . . . .



MODEL JR

Bulletin 651

W. H. NICHOLSON & CO. 213 OREGON ST. WILKES-BARRE, PA.

Sales and Engineering Offices in 55 Principal Cities

Recently Developed

3-WAY
FULL AREA, PACKLESS
SOLENOID VALVES

SIZES:
1, 1¼, 1½ and 2 inches

We recommend this valve for controlling equipment where pressure must be alternately applied and exhausted as, for example, with diaphragm motor valves, air or hydraulic cylinders, etc. Classed as Bulletin 8331 ASCO Valves, here are a few specifications: pipe sizes 1, 1¼, 1½ and 2 inches. Maximum pressure 125 to 250 pounds; minimum pressure 10 to 20 pounds. Suitable for handling air, water, gas, oil and other non-corrosive gases or liquids up to 180°F.

Since the automatic control of any alternating application and release of pressure is so important for efficient operation, we suggest that you bring your problems to the attention of our engineers. Designing just such controls has been our business for nearly forty years. If Bulletin 8331 Valve doesn't seem to fit your requirements, we have many other types—all in the broad class of automatic control units. Or, if necessary, we shall be glad to design a new type of valve to fit your special needs.

ASCO Solenoid VALVES

If you have recurrent and varying needs for automatic control valves, you should have our General Valve Catalog No. 23.

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

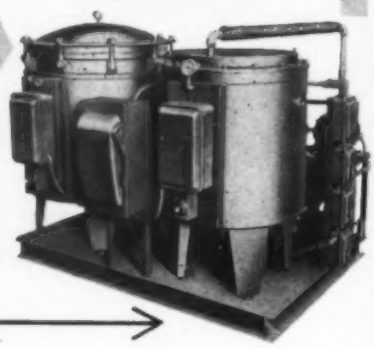
Automatic Switch Co.

385-H LAKESIDE AVENUE • ORANGE, NEW JERSEY

Circle 53 on Reader Service Card

Restores used hydraulic oil to like-new condition

HOFFMAN OIL CONDITIONER



Removes soluble and insoluble impurities
Capacities from 25 to 600 g.p.h.

Protects your hydraulic equipment—lengthens oil life without high maintenance cost of centrifuges. The Hoffman Oil Conditioner consists of a cartridge filter and vaporizer, mounted on a common base, portable if desired. Complete with all necessary electric and pump connections. Only two moving parts—no steam or water connections. Write for technical bulletins.

FILTRATION DIVISION

U.S. HOFFMAN MACHINERY CORPORATION

218 LAMSON STREET, SYRACUSE 6, N. Y.

CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

Circle 55 on Reader Service Card

ALLEN TRU-ROUND DRYSEAL PIPE PLUGS

100% PRESSUR-FORMD.

- NEVER OUT OF ROUND
- LEAKPROOF METAL-TO-METAL SEAL
- FULL STRENGTH SOCKET WON'T STRIP OR WEAR

Ideal for extreme pressure applications. For use with dry-seal taps. No sealing compound required. Pressur-Formd socket, unweakened by drilling and broaching, is stronger than the strongest key. Pressur-Formd burnished threads are nick and distortion-free, insure perfect thread contact, won't gouge softer metals. Perfect taper plus 360° roundness at both pitch and crest diameters assure accurate fit. Now available in 1/16" to 1-1/4" sizes. No increase in price.

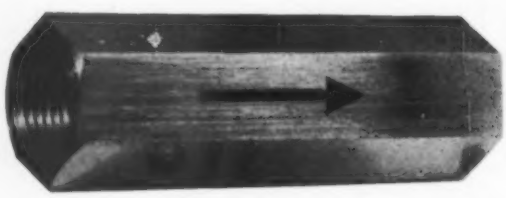
Sold only thru leading distributors. Write direct for samples and engineering data on Allen Dryseal plugs, also Allen Tru-Round *Standard* Pressur-Formd plugs for a better seal in normal applications.

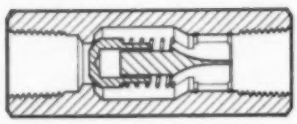
WARNING
Allen-TYPE screws aren't necessarily Allen-MADE. Be sure to get genuine Allens in the black and silver box.

ALLEN HEAD

ALLEN MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

CHECK VALVES FOR OIL





- LOW PRESSURE DROP
- ONE PIECE BODY
  - NO GASKETS TO LEAK
  - WILL NOT COME APART
  - WHEN FITTINGS ARE REMOVED
- ECONOMICAL

FLUID CONTROLS, INC.

Box 1868 Willoughby, Ohio

Circle 54 on Reader Service Card

GOOD PACKINGS *must start with* the TANNING

To make Rhoads Tannate Leather Packings a wide variety of specially developed packing leathers are used. These have been tanned by our own process, the culmination of nearly 250 years of producing fine leathers. Skilled craftsmen, long experienced in packing manufacture and application, precision mold and custom finish Rhoads Packings to meet your exact requirements and specifications.

U—VEE—CUP—FLANGE

RHOADS Tannate® LEATHER PACKINGS

Specify Rhoads Tannate Leather Packings for more dependable service, increased production and lower costs. *Write for details.*

PRODUCERS OF FINE LEATHER FOR 249 YEARS

J. E. RHOADS & SONS

35 North Sixth Street, Philadelphia 6, Pa.

Circle 52 on Reader Service Card

POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

A. J. Weatherhead, Jr., President of **The Weatherhead Company**, recently announced that **B. R. Teree** has returned to the company as chief engineer of the Aviation Division. Mr. Teree's former association with The Weatherhead Company began in 1946 in the capacity of Project Engineer and he was later advanced to Director of Laboratories and Engineering Manager.

B. R. Teree

Known to his many friends throughout the aviation industry as "Bob", he will continue to serve (for the seventh consecutive year) as chairman of the S.A.E. Committee—A-6—Aircraft Hydraulic and Pneumatic Equipment, and also as a member of the S.A.E. Committee—A-1—Aircraft Pumps. In addition, he is a member of the American Society of Mechanical Engineers, the Society of Automotive Engineers, and is an Associate Fellow of Aeronautical Sciences.

The J. M. Grimstad Company, sales engineering representatives for hydraulic and pneumatic equipment have moved to 8230 West Bluemound Road, Milwaukee 13, Wisconsin.

Garco Machinery Company, manufacturers' representatives for hydraulic components and machinery, have moved to new enlarged headquarters at 21000 St. Clair Ave., Cleveland 17, Ohio.

As a result of expanded operations of the Pacific Division plants of **The Parker Appliance Company** at Los Angeles, the Division has been incorporated as the **Parker Aircraft Co.**, a wholly - owned subsidiary of the parent company, it is announced by S. B. Taylor, Parker president.

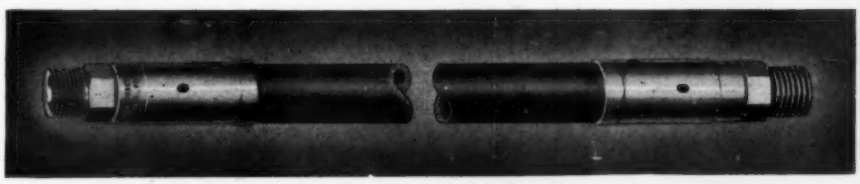
J. L. Christian has been elected a vice president of **Monsanto Chemical Company.**

MULCONROY

Hydraulic

HOSE ASSEMBLIES

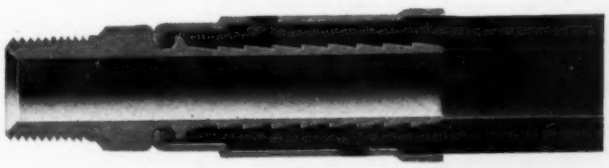
Complete units, ready for quick, easy installation on all types of hydraulic equipment. Available in three basic hose constructions to meet all required working pressures. Full range of sizes; lengths to 50 feet.



With "PRESS-LOCK" *Couplings*

The "PRESS-LOCK" is based upon an entirely new coupling-to-hose anchoring principle which assures strength, durability and safety unequalled in any other coupling of the pressed-on type. The hose itself provides a major portion of the coupling's tremendous holding power through its displacement inside the coupling sleeve. Because the **entire hose wall** is utilized—for the full length of the coupling—hydraulic hose equipped with "PRESS-LOCK" couplings will withstand shock loads and continuous flexing far beyond the limits of hose connected with conventional pressed-on fittings. Literature available.

Right: Cut-away view showing unique construction of "Press-Lock" Coupling. Note that entire hose wall is employed.



"MULCONROY *Starts...* WHERE OTHERS *Stop!*"

MULCONROY CO. *Hose Specialties Since 1887*

5329 JEFFERSON ST., PHILADELPHIA 31, PA.

V. de P. Gerbereux has been appointed manager of the centrifugal pump sales division **of Worthington Pump and Machinery Corporation.** He succeeds A. H. Borchardt who was recently elected vice president in charge of centrifugal, reciprocating and vertical turbine pump sales.

David E. Gow has been named assistant to George W. Marshall, Jr., **Raybestos-Manhattan, Inc.'s** vice president of asbestos products sales.

Harold Stone has been appointed manager of the St. Louis office and sales territory for **Quincy Compressor Co.** Mr. Stone was transferred from the company's New York office.

The Watson-Stillman Company announces the appointment of the Don W. Patterson Company, 2016 Rand Building, Buffalo, New York as its exclusive sales representative in western New York State.

The appointment of **Robert F. Hodgson** as sales manager has been announced by Hall Kirkham, president of **Hydraulic Equipment Company,** Cleveland, Ohio. Mr. Hodgson has been associated with the company since 1945, and has served in various capacities in both sales and engineering, more recently as chief engineer, in which position he will continue.

Robert F. Hodgson

The Weatherhead Company, Cleveland, announces the appointment of 9 more industrial distributors. They are: B. H. Deacon Co., Inc., American & Huntingdon Streets, Philadelphia 33, Pa.; Knox, Inc., 33 Union Street, East Walpole, Mass.; Spence Tool & Rubber Co., 1530 North Adams St., P. O. Box 895, Peoria 3, Ill.; Diesel Injection Sales & Service, 809 Union Street, Norfolk 10, Virginia, and The Harry Cornelius Company, 1510 North 2th Street, Albuquerque, N. M. In Akron and Massillon, Ohio, The Hardware & Supply Company is appointed distributor. The two other new appointments are Hydro Pneumatics, Inc., 90 West St., New York 6, N. Y. and Robins Rubber Division of A. K. Robins & Co., Candler Bldg., Baltimore 2, Maryland.

LOVEJOY

Flexible Couplings

Always Up To Expectations

You can expect the very best of service from the Lovejoy Flexible Couplings which you install on your equipment. They will give you years of trouble-free service. They do a better job of correcting misalignment without vibration and they absorb shock, backlash and surge. Lovejoy Flexible Couplings feature free-floating load cushions which are suspended between heavy metal jaws. Cushions are available for every duty . . . 1/6 to 2500 h.p. and last two to five years before changing. No lubrication is ever required. For the best in flexible couplings, specify Lovejoy.

Send for complete Catalog . . . . .

Selector Charts lead you right to the couplings you need.

LOVEJOY FLEXIBLE COUPLING CO.

5037 WEST LAKE STREET — CHICAGO 44, ILLINOIS

Also Mfrs. Lovejoy Universal Joints and Lovejoy Variable Speed Transmissions

Peter F. Hurst, president of **Aeroquip Corporation,** recently announced the election, by the Board of Directors, of two new vice presidents. **Benjamin A. Main, Jr.** vice president in charge of engineering, has been with Aeroquip since 1942 as chief development engineer. Mr. Main is a member of the Society of Automotive Engineers and the Society's committee A-3 Aircraft Valves, Fittings and Flexible Hose Assemblies. **H. L. Schrock, Jr.,** vice president and treasurer has been with the company since 1947.

B. A. Main, Jr.

S. D. Andrews, who joined **General Controls Co.** of Glendale three years ago in the company's San Francisco branch, has been appointed branch manager of the Dallas, Texas office. Andrews will replace **Robert Farmer** who will return to the Glendale plant as a factory engineer.

Leonard H. Seeman, who formerly was employed by **Greer Hydraulics, Inc.** and then joined the Waldorf Instrument Co., has now rejoined Greer Hydraulics, Inc. in the capacity of expediter for purchasing and production.

Linear, Incorporated announced the promotion of **John H. Swartz** to the position of chief engineer. Mr. Swartz will direct all engineering activities of the company including design and product application of its line of packings and moulded products for both the industrial and aviation fields.

The Cleco Division of the Reed Roller Bit Company, has announced the appointment of Elect Air Tool Co., 310 W. Verdugo Ave., Burbank, Calif., and W. E. Mushet Co., 725 Bryant Street, San Francisco 7, Calif. as distributors for Cleco products in their areas.

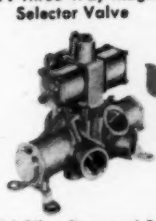
Allrubber Products & Supply Co., Milwaukee, Wisc., The Neff-Perkins Co., Cleveland, and Air Associates, Inc., International Airport, Miami, Fla., have been appointed distributors for "O" rings manufactured by **The Parker Appliance Co.**

for better
automatic control
better check
general controls

PV-1 Magnetic Normally Closed Valve

PV-2 Magnetic Normally Open Valve

PV-11 Three Way Magnetic Selector Valve



PV-14 Pilot Operated Four Way Selector Valve

When it comes to automatic control of temperature, pressure, level or flow, America's leading design engineers agree that for the *best* in automatic controls, it's General Controls. The General Controls "hi-g" line of automatic temperature, pressure, level and flow controls are especially designed for use on any equipment that rolls, flies or vibrates. Positive operation in any position regardless of vibration, change of motion or acceleration, is assured. There is a General Controls Factory Branch Office as near as your telephone in 29 cities across the country. General Controls Design Specialists will welcome inquiries from Design Engineers. So for better automatic control tomorrow . . . better check General Controls . . . today!

hi-g*

* "hi-g" indicates positive operation in any position regardless of vibration, change of motion or acceleration.

GENERAL CONTROLS

GLENDALE 1, CALIF. 801 ALLEN AVENUE

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cleveland 15, Columbus 15, Dallas 2, Denver 4, Detroit 21, El Paso, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Milwaukee 3, Minneapolis 2, Newark 6, New Orleans, New York 17, Omaha 2, Philadelphia 23, Pittsburgh 22, Salt Lake City 4, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6, D.C.
DISTRIBUTORS IN PRINCIPAL CITIES

POWER...

• ECONOMICAL
• RUGGED
• VERSATILE

Flange Mounting

Double End Rod Mounting

Trunnion Mounting

LINDBERG AIR & HYDRAULIC CYLINDERS

Base Mounting

Foot Mounting

Rabbet Mounting

Pendulum Mounting

For Pulling—Pushing—Lifting—Forcing—Clamping—Pressing

Whether it's one of the 12 standard bore sizes in one of the seven mounting types — or a special cylinder built to your specifications — there's a Lindberg Air or Hydraulic cylinder for your specific need.

Remember — Lindberg cylinders effect great savings through the reduction or elimination of costly mechanisms formerly needed for a variety of power purposes — and their adaptability and ruggedness makes them useful for many industrial purposes.

WRITE FOR BULLETIN 731

Get complete details on all standard Lindberg Air Cylinder models and sizes with complete tables on bores, pressures, weights, mountings and conversion to low pressure hydraulics.

LINDBERG AIR & HYDRAULIC CYLINDERS

Lindberg Engineering Company, 2441 W. Hubbard Street
Chicago 12, Illinois

Stoker Transmission

(Continued from page 39)

operation and at the same time to proportionately vary the grate speed and fuel feed relationships over the entire range of operations so as to correct for ash content and other variations in fuels used.

The hydraulic drive arrangement which is installed on the most recent boiler unit was determined after considerable experimental operation on another Detroit Roto-Grate Stoker that had been operating for some time. In this case we experimented with several different types of variable speed transmissions in order to obtain actual operating experience as to reliability, precise control characteristics, etc. We also experimented with two types of electric variable speed drives.

The hydraulic units proved superior in almost every category. We were particularly

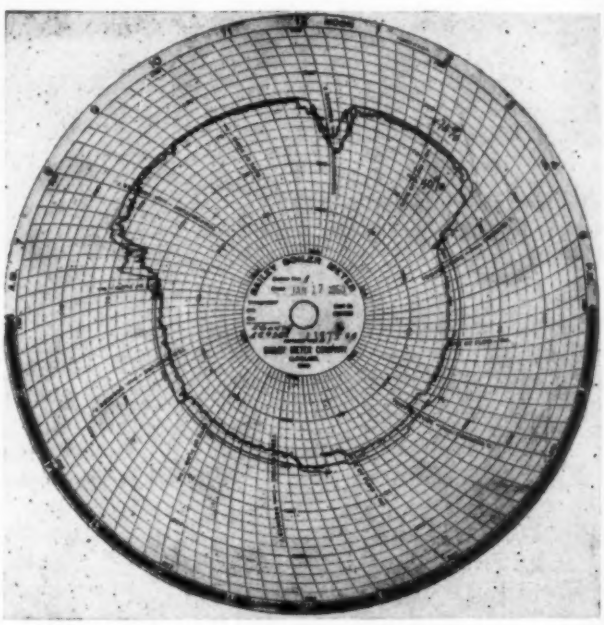


Fig. 3. A daily recording chart or boiler meter showing how closely the automatic hydraulic control of feed rate and grate speed follows the power requirements through an average 24 hours of operation.

impressed with the reliability and trouble-free operation obtained with the hydraulic system. The experimental installation operated continuously for about a year and one-half without difficulty of any sort. This was far better than we were able to obtain with any of the other drives tested. This test was done in 1947 and 1948 and in 1949 the new boiler unit was installed using the drive arrangement which had been proven in our tests.

Figure 1 is a general view of this installation,

and Figure 2 shows the hydraulic drive motors. It will be noted that the fuel feed mechanism is driven by a constant displacement motor. Immediately below this is a variable displacement motor which drives the right hand half of the grate. The left hand half of the grate is driven with a constant displacement motor. The reason for the two different types of motors on the grate drive is that they are operated in series, and the variable speed displacement motor is adjusted to compensate for any difference in speed characteristics of the two units in series as well as to allow for the loss of efficiency through the first motor in series.

Stoker Operation in Summer

During the summer months it is necessary for the boiler unit to operate about eight hours of the day at loads under 15,000 pounds per hour, and this is easily handled under full automatic control. Also over weekend periods we operate at loads of 5,000 to 7,000 pounds per hour and still under full automatic control.

Figure 3 shows a typical daily operation. In this case load variations and how closely the control system followed these variations is clearly shown.

We have now had approximately 1-½ year of experimental testing with the hydraulic drive units and actual operation on the new units of 17 months, which brings our total operating experience to date to 35 months. The operating experience over this period of time has conclusively demonstrated hydraulic units with their control characteristics to be superior to any other type of drive arrangement that we know about.

Internal Ram Design

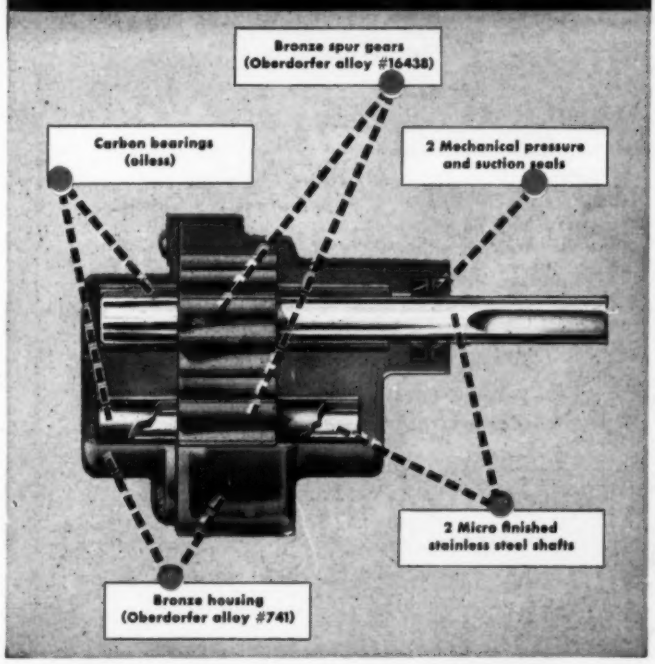
(Continued from page 41)

stationary ram secured to the top cylinder ram.

Two of the three press functions are only used when making a die set-up. A limit switch which is actuated only when the dies are properly placed by the horizontal sliding table cylinder makes it possible to then operate the two clamp cylinders. The clamp exerting 200 tons pressure on the die assembly must be fully made to close a pressure switch permitting movement of the main ram. A separate small volume, high pressure oil system powers the positioning and clamp cylinders.

A preheated slug about two inches in di-

Series I BRONZE
OBERDORFER INTERNATIONAL
ROTARY GEAR PUMPS

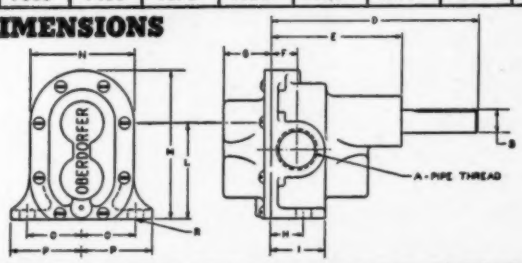

Bronze spur gears (Oberdorfer alloy #16438)
Carbon bearings (oilless)
2 Mechanical pressure and suction seals
2 Micro finished stainless steel shafts
Bronze housing (Oberdorfer alloy #741)

These precision built pumps have been specifically designed for long and economical service, and to reduce liquid transfer costs in a vast variety of industrial applications. Their five major points of superiority incorporate all the engineering and production knowledge amassed in building millions of bronze pumps over a period of more than 50 years.

Capacity Tables Gallons per hour—1,725 R.P.M.—lbs. sq. in.

Size	No.	2 lbs.	20 lbs.	40 lbs.	60 lbs.	80 lbs.	100 lbs	Price
1½	1000	126	115	105	98	93	90	$14.25
2	2000	245	225	215	205	195	190	15.75
3	3000	445	425	405	390	380	370	20.00
4	4000	640	610	580	550	530	510	22.25
7	7000	1185	1160	1140	1120	1100	1085	28.50
9	9000	1400	1375	1350	1325	1300	1280	29.75

DIMENSIONS



Size	A	B	D	E	F	G	H	I	L	M	N	O	P	R
1½	¼	½	3 11/16	2 3/16	7/16	1 1/8	7/16	1 1/16	1 7/8	2 7/8	1 15/16	7/8	1 1/4	5/16
2	3/8	½	3 11/16	2 3/16	15/32	1 1/8	¾	1 3/16	2 23/64	3 3/16	2 3/8	1 1/2	1 3/4	5/16
3	½	5/8	4 1/16	3	17/32	1 1/4	¾	1 1/4	2 5/8	4	2 3/4	1 7/16	1 7/8	13/32
4	½	5/8	5 1/16	3 7/16	11/16	1 1/4	7/8	1 7/16	2 5/8	4	2 3/4	1 7/16	1 7/8	13/32
7	¾	5/8	5 5/8	3 7/8	¾	1 1/4	7/8	1 7/16	3 5/16	5 1/4	3 3/4	1 5/8	2 1/8	13/32
9	1	5/8	5 7/8	3 7/8	7/8	1 1/4	7/8	1 11/16	3 5/16	5 1/4	3 3/4	1 5/8	2 1/8	13/32

AH-5110

INDUSTRIAL PUMP DIVISION
Oberdorfer Foundries, Inc.
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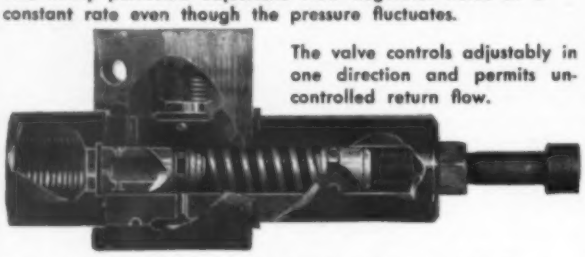
An adjustable FLOW REGULATOR

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.



The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

Four sizes, ¼, ⅜, ½, and ¾ inch. Overall length, 4½ to 7½ inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

Write for illustrated circular.

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2121 CUSTER AVENUE • EVANSTON, ILLINOIS

7,632,113 OPERATIONS

Actual performance of a standard 3/8", 4 - Way AUTOMATIC solenoid valve before maintenance was required.

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CYCLING TO 600 PER MIN.

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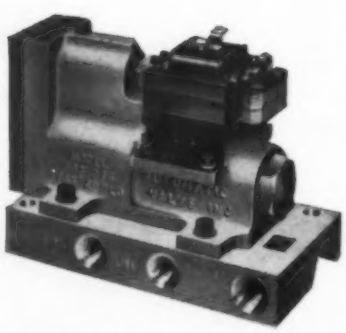
FOR CONTROL OF COMPRESSED AIR-PRESSURES 20 TO 150 LBS.



Available in standard pipe sizes.

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PIONEERS and SPECIALISTS in PILOT OPERATED SOLENOID CONTROLLED VALVES

AUTOMATIC VALVE CO.
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Circle 62 on Reader Service Card

ameter and four inches long is placed in the heated die. Die temperature of 1200 F is maintained by an induction heating coil. The operator steps on a foot switch and pressure oil from a 24 gpm pump enters the internal cylinder, to give fast approach. When the punch contacts the slug, pressure builds up to open a sequence valve which admits pressure to the main cylinder for extruding the work. A surge valve supplies the large oil volume necessary to fill the main cylinder.

At the bottom of the main cylinder stroke, a cam contacts a limit switch to return the punch to the up position. In the up position another limit switch is tripped to complete the cycle.

Only with the main ram and clamp cylinders in their top positions can the sliding table be moved to change the die.

In making this wire, the butt end of the slug is not removed as in ordinary extrusion processes. Instead, another slug is placed in the dummy block on top of the butt end and the two are welded under the extrusion pressure and temperature in the assembly. This procedure produces a continuous coil of wire that can subsequently be drawn to smaller diameters.

Circuit Hints

(Concluded from page 48)

ing and unloading operations on the pierce circuit described in September. However, in that circuit a double solenoid, 4-way, three position valve serves to unload the pump by having an open center neutral position.

This month's circuit also uses the open center 4-way, double solenoid valve. One timer is again used to reverse the stroke. In place of the second timer used in the September circuit a limit switch is used to unload the pump.

The timing relay is energized when the start button is depressed closing contacts 6-4. Through closed contacts 4-7, forward solenoid is energized and the work cylinder moves forward. When the pierce operation is completed the timer times out deenergizing the forward solenoid and energizing the return solenoid through contacts 4-8.

At the end of the return stroke normally closed limit switch 1 is tripped open breaking the holding circuit for the timing relay, which now drops out, deenergizing the return solenoid to cause the directional valve to move to neutral. The pump volume is unloaded to tank at zero pressure through the directional valve, thus requiring little power during idle time.

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Now! CONTROL AIR OPERATIONS ELECTRICALLY!

PUSH BUTTON OR LIMIT SWITCH CONTROL FOR

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- AIR CIRCUITS
- AIR-OPERATED PRESSES

Quiet . . . dependable . . . economical. Unlimited range of applications. Ideal for remote control or for building into equipment. Two types. Ask for Hannifin recommendations.

GET BULLETIN 230

Contains specifications, dimension table, wiring diagrams and other useful data.

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The Higher the Pressure ...the Tighter the Valve

On hydraulic presses of all types this Yarway Hydraulic Valve will give long life with minimum maintenance. Automatically regrinds its own sealing surfaces. Small and compact. Easy to install and operate.

Yarway Single-Pressure Hydraulic Valves are made in straightway, three-way and four-way types; in five sizes for pressures up to 5000 lbs. Also Yarway Two-Pressure Valves in two sizes for pressures up to 5000 lbs. Write for Bulletin H-210.

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Improved Type
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SAVE UP TO 85% in WAR SURPLUS HYDRAULICS

SPECIAL BARGAIN #29 HYDRAULIC CYLINDER

Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1¾" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW 29.95

3A HYDRAULIC CYLINDERS

NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" 5.75
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15¼" 8.50
NO. 35 – Bore 1½", Shaft 1" Stroke 26", Length 23½" 15.75

HYDRAULIC TRANSMISSION

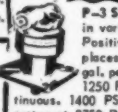
Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 32.50

AN-Hi-Press. HOSE (FUEL – OIL & AIR)

1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each. Same as above but 63" long. . . . . $3.75 each.
1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.65 each. Same as above but 67" long. . . . . $3.75 each.
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each. Same as above but 36" long. . . . . $2.95 each.

HYDRAULIC PUMPS

ANGLE PUMP Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM, intermittent maximum 4500 RPM. Rotates to the right only. . . . . NEW 17.50

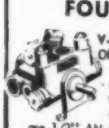


P–3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotation either direction without adjustments. NEW 17.50

GEROTOR TYPE PUMP

Logan Gerotor type. For operating hyd. systems on tractors, trucks industrial machinery, etc. Delivers 8 GPM, at 1200 RPM, at 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stnd. pipe ports, ½" splined shaft for pulley or direct attachment. 5½" dia. x 7" lg. Used but guaranteed condition. New ONLY 19.50

FOUR WAY VALVE



V-17 Poppet type. Pressure balanced. Off at-neutral position. Piston type with built-in relief valves for limit of cylinder strokes. Has 5/8" AN tube size (7/8"–14 thread) inlet and outlet. Ports to the cylinder are 1/2" AN tube size with 3/4"–16 thread. Many more in stock. Send for list. 9.75

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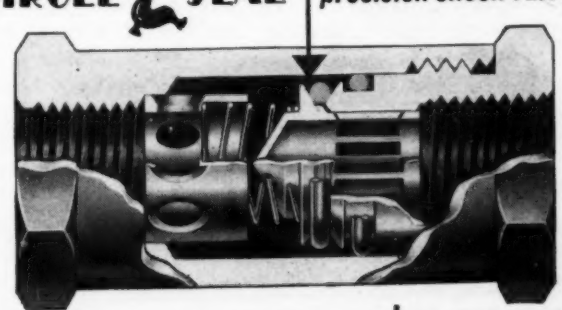
provides positive, bubble-tight sealing with exceptionally low cracking pressure and pressure drop. The resilient "O" ring absorbs the closing shock insuring quiet trouble-free operation.

insures absolutely leak-proof performance unequalled in any check valve

***Pressures:* 0 to 3000 psi**
***Temperatures:* –65°F to 280°F**
***Sizes:* 1/8" to 1"**

CIRCLE SEAL *precision check valves*



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Engineering data sent free of charge on request.

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Standards File Sheet

Know Your Component Symbols

DIRECTIONAL VALVES

Hydraulic Series

DIRECTION OF PRESSURE OIL from the pump must be controlled to impart desired motion and reversal of motion to the cylinder or fluid motor.

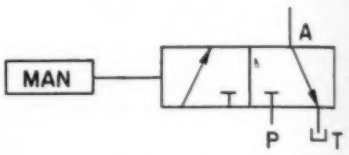
In most hydraulic systems directional control is provided by a spool type valve. The spool sliding in a sleeve or housing opens or blocks ports to give the desired direction of oil flow.

Movement of the spool may be done by one of the following methods:

1. manual, by use of handle or treadle
2. electrical, by the actuation of a solenoid
3. pilot, by applied oil pressure to the spool end
4. combination of both pilot and solenoid
5. actuation of the spool by mechanical cam or pusher
6. actuation by an air cylinder directly connected to the spool.

There are many possible combinations of directional valves. In the next several months this series will present symbols and schematics for commercial styles.

Two position, 3-way valve



J.I.C. Symbol

NEUTRAL

Schematic 3-Way Valve

The symbol shows the two valve positions which are determined by the actuation of the control. This control, shown as manual, may be any of the methods listed. When placed in a circuit the valve is shown in its neutral position, which in this case has the pressure port blocked and the utility port open to tank. When the valve is shifted, pressure flows to the utility and the tank port is blocked. Of course the three ports may be connected in other combinations. The one shown here is the most common and serves to illlustrate the symbol function.

Two position, 4-way valve

The symbol shows a spring offset to hold the valve in neutral position. When the valve control is shifted, it must be held to maintain the second po-

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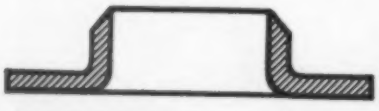
Precision
Where You Must Have It!

Molded to offer automatic lip action with heel clearance—positive seal and minimum frictional drag on the rod.



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Periflex Inc.

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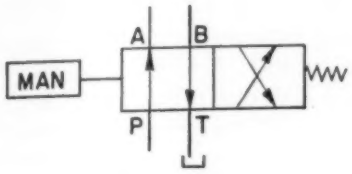
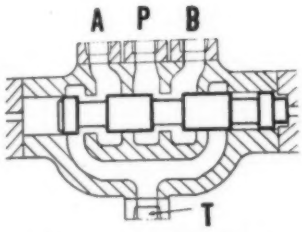
sition, releasing the control permits the spring to return the valve. Valves without



J.I.C. Symbol



Schematic 4-Way Valve

springs require shifting the control to each of the two positions. The symbol indicates oil flow through the valve while in each of the two positions.

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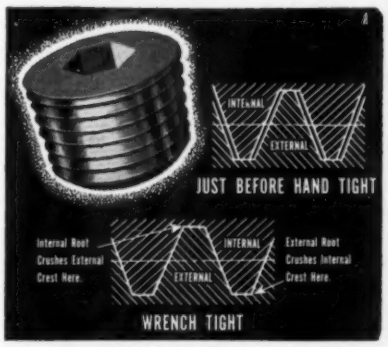
UNBRAKO®

DRYSEAL THREAD PRESSURE PLUG



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Here's a "small package" replacement for bulky, hard to mount airsets . . . providing precise REGULATION in ranges 0-30; 0-60; 0-125, psi, for inlet pressures up to 150 psi . . . with ability to filter out particles down to 40 microns! Investigate ConoAirpak for all installations requiring more efficiency . . . less space, installation time, maintenance and initial cost. Forged brass and stainless steel construction for corrosion resistance—simplified mounting—large capacity reducing valve with safety relief. Available in a variety of ranges, filter areas, and drip-well capacities.
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WITH THE ARDEE 4 WAY VALVE

The ARDEE valve controls AIR, WATER, OIL, VACUUM and various GASES up to 150 lb. psi for gases and 200 lb. psi for liquids.

There is an ARDEE valve for every job. Depending on the service requirements, valve bodies can be furnished in brass or aluminum. The sealing members are molded of various resilient materials suitable for those requirements.

JUST A FEW APPLICATIONS: . . . *Road machinery, plastic machinery, tire retreading machinery, special installations, material handling equipment, vacuum spray booths, vacuum material handling, punch press operations, hydraulic press, platen presses for rubber industry.*

SIMPLE EXTERNAL ADJUSTMENT KEEPS ARDEE VALVE LEAK PROOF • The ARDEE valve employs the N.I.F. principle • Closed center on all ports • Metering principle • Easy mounting features • Low handling load • Ports and passages unobstructed.

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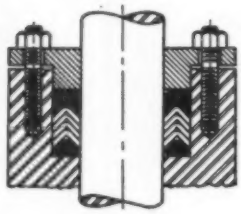
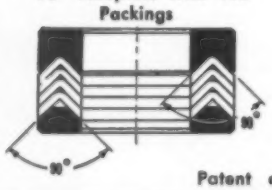
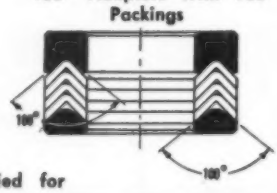
Your Choice of Included Angle (90° or 100°)
Bronze V-DAPTORS are made from very strong metal — reasonable in cost — accurate in dimension — last the life of the machine—support Vee packing properly helping them to seal efficiently—become permanent part of the machine. Send for brochure for further information. Sizes carried in stock for immediate delivery.



RODgers BRONZE V-daptors With Vee Packings in typical Stuffing Box installation.



90° Adaptors With Vee Packings



100° Adaptors With Vee Packings

Patent applied for

THE GILSON COMPANY, INC.
75 EAST WACKER DRIVE • CHICAGO 1, ILLINOIS

Packaged Controls

(Continued from page 35)

holding circuit of pilot valve solenoid "B", thus de-energizing same. This opens port 2 to tank releasing the hydraulic pressure behind the piston pump charging valve permitting all oil being pumped by the traverse pump, except that required to charge the piston pump, to by-pass directly back to tank at approximately 60 psi. This puts the machine into controlled feed at a rate determined by the setting of the fine feed adjusting knob on the pump housing. The saws now mill their way into the rings to a depth controlled by the setting of the adjustable switch plate which carries LS-2. At the desired depth of cut, a button on the end of the slide closes LS-2 which is in the make circuit of solenoid pilot valve "A", through relay "A". This directs a flow of oil through valve ports 4 and 1. This shifts the spring loaded 4-way valve spool into position to reverse the flow of oil to the blind end of the cylinder and also covers port 2 internally to lock the charging valve closed, putting the machine into rapid return.

The return stroke automatically indexes the

Leather Crimping Machine

Air-Powered by NOPAK Cylinder

FRONT VIEW shows crimping blade and adjustable heated jaws; air and thermostat controls mounted at left.

REAR VIEW shows NOPAK Model "E" 4" x 8" stroke Cylinder, with self-regulating cushion at both ends.

The crimping machine pictured was developed by Western Supplies Co. of St. Louis. It "makes shoes fit better" because it preforms leather upper sections, under heat and pressure, so that they can be subsequently drawn snugly against the lasts.

NOPAK Air Cylinder Power was chosen to reduce operator fatigue and increase production . . . to utilize controlled line pressure over the full range of crimping operations . . . to eliminate working parts . . . and because NOPAK mounting characteristics were best fitted to the machine. A study of the cylinder's construction indicated there was "practically nothing to wear out." It was also found to meet the high standards required at a comparatively low price.

Write for Bulletin SW-1 or refer to Sweet's File for Product Designers.

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VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

GALLAND-HENNING MFG. CO.
2743 S. 31st St. • Milwaukee 46, Wis.
Representatives in Principal Cities.
A 5958-½H-A

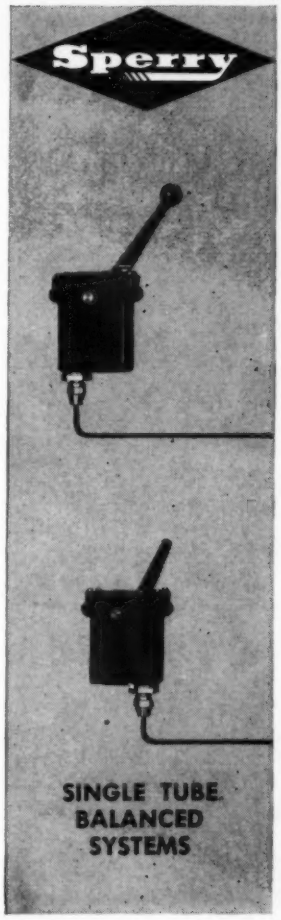
workhead mechanically the required number of degrees. At the extreme limit of the rapid return stroke, and at the completion of the index, a locking plunger carrying a switch operating cam slides in, locking the face plate in position for the next cut. In moving into its locking position, the cam lobe passes the roller of LS-1, momentarily breaking a pair of N.C. contacts and momentarily making a pair of N.O. contacts.

The pair of N.C. contacts being momentarily opened are in the holding circuit of solenoid valve "A", thus breaking this circuit and de-energizing "A". This blocks valve port 4 and opens pump port 1 to tank through valve port 1. This allows the spring loaded 4-way valve spool to shift to its original position, directing the flow of oil once again to the rod end of the cylinder for the approach stroke.

The normally open pair of contacts that are momentarily closed are in the make circuit of the pilot valve solenoid "B" which thereby again becomes energized putting the machine into rapid traverse. This sequence then repeats itself for the required number of cycles at which time a cam lobe on the work spindle index plate closes the N.O. contacts of LS-3. This circuit is a parallel circuit to the holding

(Continued on next page)

Circle 74 on Reader Service Card



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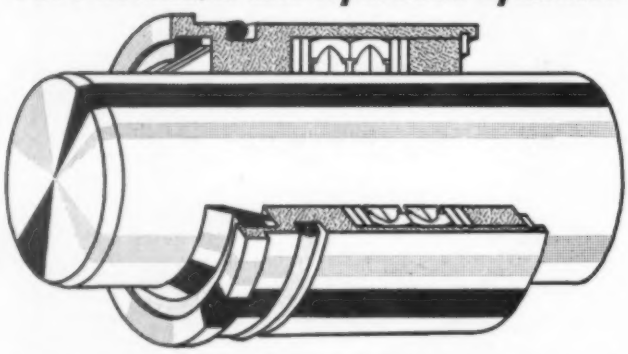

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Packaged Controls

(Continued from preceding page)

circuit of solenoid "A" through LS-1, and although LS-1 opens momentarily when the latch slides in, solenoid "A" remains energized through the over-riding of LS-3.

With the slide at the limit of its stroke, and oil still being directed to the rod end of the cylinder, the pressure in the system immediately starts to rise. In a fraction of a second, the pressure will rise to the setting of the pressure switch which has a pair of normally closed contacts in the holding circuit of pilot valve solenoid "C". At this instant, the pressure switch contacts open, thus de-energizing "C". This opens pump port 3 to tank through valve port 3, thus shifting the neutral valve into the neutral position, by-passing all the oil from the traverse pump back to tank at negligible pressure.

A spring loaded surge chamber in the pressure switch hydraulic line is used to absorb all high pressure pulsations of short duration that may occur at any time in the normal cycle operation of the machine.

An auxiliary cam lobe opens the N.C. contacts of LS-4, thus stopping the saw spindle

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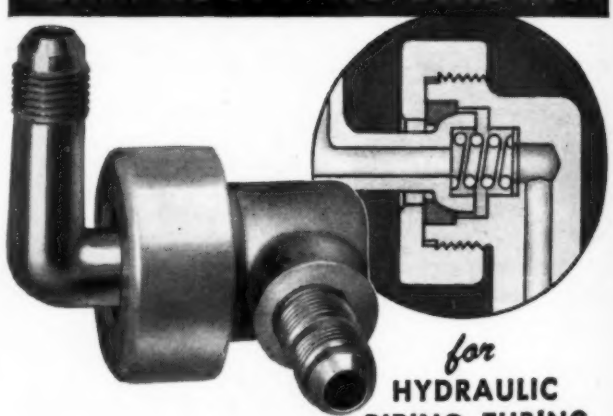

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motor, through a magnetic starter. This remains off during the unloading and reloading period and automatically turns on when the work spindle slide moves forward permitting the LS-4 contacts to reclose. A toggle switch on the side of the magnetic starter in series with LS-4 provides a positive disconnect.

Provide for Emergency Stop To Retract Slide

A push-button station with mushroom head "stop" button has been furnished as an emergency stop. Pressing this button momentarily will retract the work slide at any time. The function of this emergency "stop" circuit is simply a parallel of the circuit controlled by the limit switch LS-2. Holding the "stop" button open while the latch slides in prevents solenoid "A" from de-energizing by overriding LS-1. The circuit pressure builds up and throws the system into neutral through the pressure switch and solenoid "C", exactly the same as described for the end of the normal cycle.

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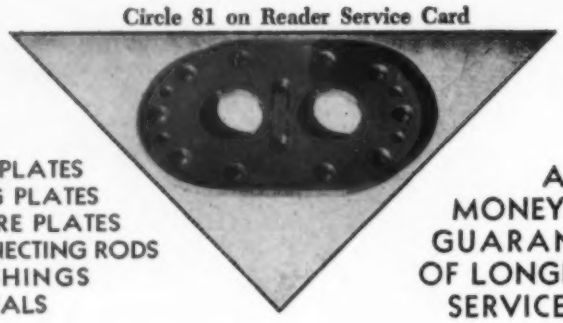

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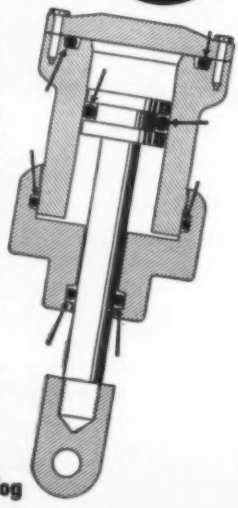

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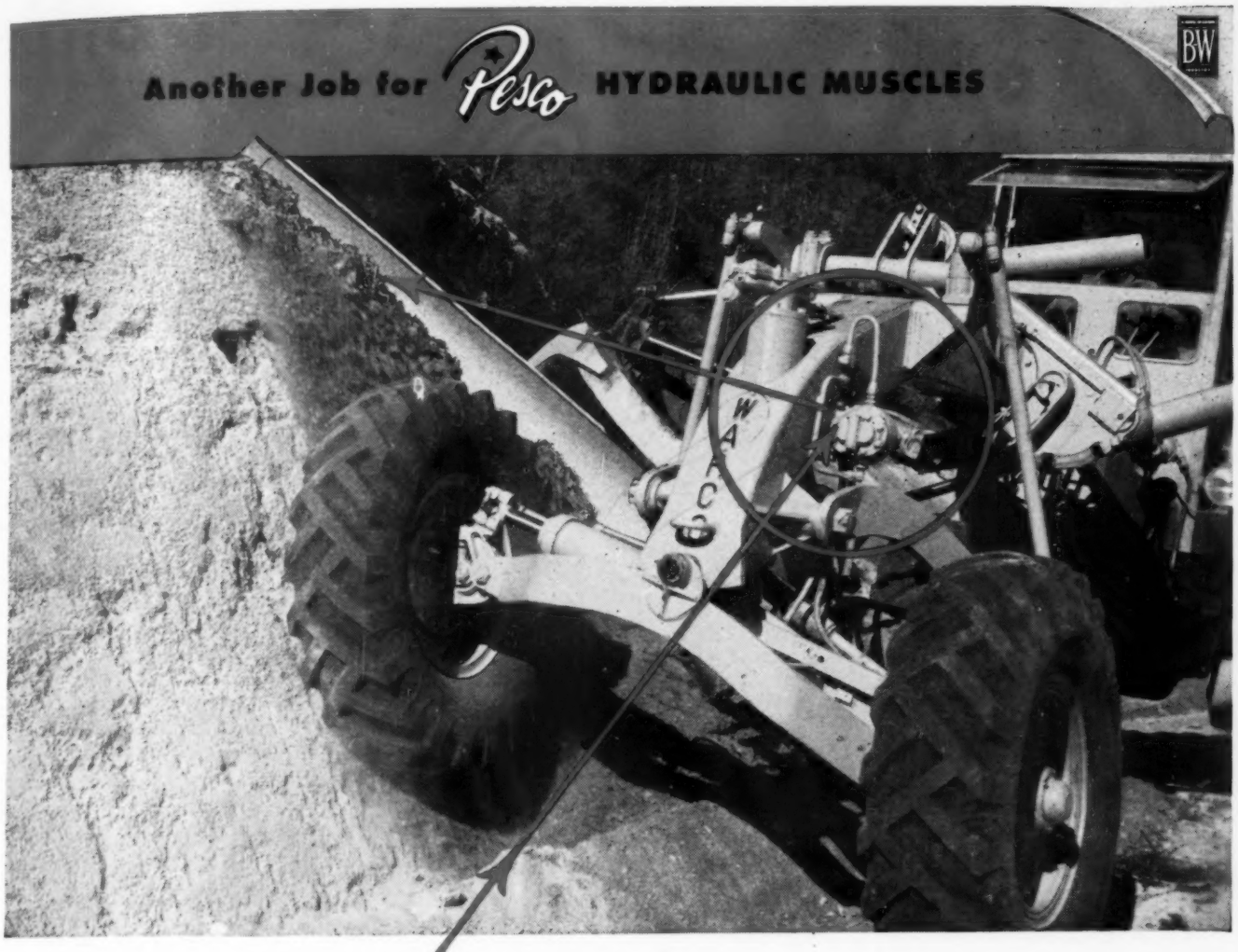
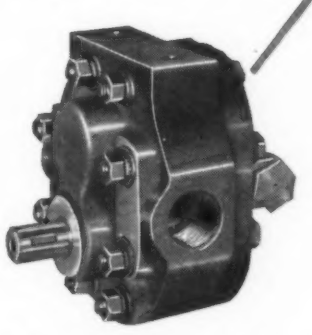


A TINY PESCO MOTOR POSITIONS HEAVY GRADER BLADE FOR 100 h.p. THRUST



This is the Pesco motor on the Warco Grader. It has a displacement of 6.1 cu. in. and 85 lb. torque per 100 psi at 1000 psi operating pressure.

The Warco Grader is a tough, rugged machine, built for the roughest kind of hard work. Every part takes a severe beating on every job . . . including the Pesco hydraulic circle turn motor.

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